Guide to using the notebook (for team, omit page when submitting for tournament)

Rules:

1. Only new pages will be printed as proof of not editing old ones, so DO NOT edit older pages in any circumstances.
2. When making a new page, copy and paste slide 2 into the latest end of the notebook and then edit it accordingly (title, what you did, date you wrote it, who contributed to it, and page number at the bottom)
3. Do not add anything that would get you or us in trouble with the school or with vex
4. Remember to log new entries (pages) in the table of contents.
5. Ask ------- if you have any questions

Slide Template (Title Here)

High Stakes
Digital Notebook

Team 6978B - Roger66

Members: ------- -------, ------- -------, ------- -------, ------- -------, ------- -------

Start Date: 6/8/2024 - Format made by ------- Z.

Important Information

This is the first digital notebook for team 6978B - Roger66

This team is part of ------- High School's VEX Robotics Program. If the binder/book containing these pages is found, find an official of HHS or a team member of 6978 to return it.

Other information:

VexForum account (run by ------- -------) - @soritarian1

Third-Year VEX team

Format used created by ------- ------- and team 6978

Ask ------- in person or on the Forum if you want to use the format

How To Read the Book - Fonts

Titles - Bold Roboto Condensed 43

Regular Text - Roboto Condensed 24 (non-bold)

Captions on images - Alegreya 18 (non-bold)

Table of Contents Entries - Roboto Mono 22

Page notes (date, contributors, etc) - Roboto Mono 17

Additional spaces between paragraphs are usually in size 20, to account for page size, as when it is 24 it can cause text to exit the page slightly. When there is only one space in a page, it is usually decreased to 16 or 18, to prevent text running off the page, but also to prevent blank spaces near the bottom. On regular pages, we use single spacing, but not these.

We use a larger text size like 24 rather than the general 12 because a smaller text size would be very hard to write in with the computers we are provided with at our school. We have deemed this necessary.

How To Read the Book - Other

The book will use numerous color codes, especially for categorization to the multiple steps of the Engineering Design Process, which we will follow in our building, designing, and documentation. The following colors correspond to:

Light Red - Identify

Light Orange - Brainstorm

Light Yellow - Select

Light Green - Create (Program, Design, Build, Notebook)

Light Blue - Testing

Light Purple - Repeat

Light Gray - Uncategorizable / Other

The book, in normal pages, will usually use single-spacing between sentences and paragraphs and such.

Not all parts of every tiny process will be documented - for example if we do multiple tests and fixes on a system during 1 day that would mean 24 pages, which we cannot do.

Identify pages will be used as introductions to new ideas.

Table of Contents: Pre-Season

Table of Contents: Season Start

Table of Contents: Season Start

Table of Contents: Season Start

Introduction to The Notebook

Welcome to 6978B - Roger66's VRC Digital notebook for the VEX Robotics 2024-2025 season, High Stakes.

Some important things to note before continuing:

1. This notebook was made with its own format. We decided that using our own template that we have created (rather than an official or community one) would fit our interests best by allowing us to display and communicate what we need to in a more streamlined and efficient fashion.

2. This notebook will not have pages edited after previous submission (Example: Once this has been page has been turned in at a competition, it will be turned in exactly the same at the next.

3. In most cases, this notebook will probably be printed out and put in a binder, page by page. This makes it easier to carry around and submit, and also provides proof of honesty in terms of not changing things about pages. (Explained on page 3)

Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on:

Notebook Organization PT. 1

We plan to organize the notebook and how we make entries, developments, and such in certain ways. We want to make sure that the development of the book, the team, and the robot are all as clear as possible and qualifying well under the Notebook Judging Criteria (See pg. 4).

How will we do this? Well, we will try to make entries consistent and as detailed as possible, while still being readable and making it clear what was done and what the goal of the entry is. This is my (-------, notebook lead)'s third year of being a team notebook lead, but first year of doing a digital one, and with the digital notebook it opens more opportunities for more frequent entries and easier ways to collaborate with teammates so everyone has more say and gets to put more of their insights and projects into the book.

The reasons why we chose to use a digital book and how we will keep it trustworthy will be on the next pages.

Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on: Page 3-4

Notebook Organization PT. 2

There are several reasons why we decided to choose a digital notebook, rather than a physical notebook like had used previously. There are some huge benefits:

1. Faster to Create
   - Digital notebooks are much easier to edit and add on to on the fly
   - Much faster and easier (in most cases) to type rather than write

2. Naturally Neater / Better Formatted
   - Due to being typed instead of written, digital notebooks are naturally far neater
   - Using all the available tools, it is much easier to format the book how we want it and get our points across in a nicer, better organized fashion

3. Easier to collaborate
   - It is easier for any member to work on the book at any time, even at the same time, due to it not being physical.

Date of Writing:	Contributors:	Continued on:	
6/8/2024	------- -------	Page 4	

Notebook Organization PT. 3

Some do believe that using a digital notebook can be less trustworthy or genuine than a physical notebook, for several reasons. Despite this, we decided to do a digital notebook, because those problems can be solved.

Issue 1: How can you know if the book has been edited to correct previous mistakes or imperfections?

We have a school rule that means after we have printed out pages, they are final and we may not reprint those pages. This means you will always get pages as they were made the first time.

Issue 2: How can you know that the content of the book was not stolen or copied from other sources?

We will quote and link to where we have taken unofficial content from (with permission) if we do. Part of why we have our own template is so that it does not look like we could have just taken someone else's book and called it our own.

Date of Writing: 6/8/2024 Contributors: ------- ------- Continued on:

Introduction to The Team

Originally made on 6/8/24 - Rewritten and reformatted to give more details about the team alongside pages 6 and 7 which were added alongside the change on 6/21/2024.

About the team: We are all 14 years old, and third-year VEX players, with two years in the MS leagues and this being our first in HS. We are all from ------- High School. -------, -------, -------, and ------- shared a team for those two years alongside another member who no longer participates in VEX. ------- joined the team this year, though he has been in sister teams before. ------- is the captain.

------- ------- - Programmer - Notebook Lead

------- ------- has been at ------- his entire life, from preschool to the present. Alongside -------, -------, and -------, as well as another student named -------, he made it to States in 7th and 8th grade in the MS VRC leagues, both times narrowly missing a Worlds qualification. He hopes to make it to States and possibly Worlds this year.

Date of Writing: 6/21/2024

Contributors: ------- -------

Continued on: Pages 6-7

Introduction to The Team

------- ------- - Builder, Utilitarian, Design

------- ------- has been in robotics for two years, since 7th grade. He has also been to states twice in that time, He has been on the same basic team since 7th grade and is planning to stick with them the rest of high school.

------- ------- - Builder, Design, Strategy

------- ------- has also been in robotics 2 years, since 7th grade. He’s been to states 2 times. His team has been with the same team as the rest of our team besides ------- -------. And he is also planning on sticking on the same team as well,

Continued on: Page 7

Introduction to The Team

------- ------- - Builder, Design, Drive-Team

------- ------- has also been in robotics 2 years, since 7th grade. He's been to states 1 time. My team has been different for both 7th to 8th but, I am also planning on sticking on the same team for the rest of highschool. Doing my best no matter what.

The Notebook Judging Rubric

VEX Engineering Notebooks are generally judged off of the official rubric, which is below. We will follow it as best as we can, in order to improve our documentation.

CRITERIA	PROFICIENCY LEVEL		
ENGINEERING DESIGN PROCESS	EXPERT (4-5 POINTS)	PROFICIENT (2-3 POINTS)	EMERGING (0-1 POINTS)
IDENTIFY THE PROBLEM	Identifies the game and robot design challenges in detail at the start of each design process cycle with words and pictures. States the goals for accomplishing the challenge.	Identifies the challenge at the start of each design cycle. Lacking details in words, pictures, or goals.	Does not identify the challenge at the start of each design cycle.
BRAINSTORM, DIAGRAM, OR PROTOTYPE SOLUTIONS	Lists three or more possible solutions to the challenge with labeled diagrams. Citations provided for ideas that came from outside sources such as online videos or other teams.	Lists one or two possible solutions to the challenge. Citations provided for ideas that came from outside sources.	Does not list any solutions to the challenge.
SELECT BEST SOLUTION AND PLAN	Explains why the solution was selected through testing and/or a decision matrix. Fully describes the plan to implement the solution.	Explains why the solution was selected. Mentions the plan.	Does not explain any plan or why the solution or plan was selected.
BUILD AND PROGRAM THE SOLUTION	Records the steps to build and program the solution. Includes enough detail that the reader can follow the logic used by the team to develop their robot design, as well as recreate the robot design from the documentation.	Records the key steps to build and program the solution. Lacks sufficient detail for the reader to follow the design process.	Does not record the key steps to build and program the solution.
TEST SOLUTION	Records all the steps to test the solution, including test results.	Records the key steps to test the solution.	Does not record steps to test the solution.
REPEAT DESIGN PROCESS	Shows that the design process is repeated multiple times to improve performance on a design goal, or robot/game performance.	Design process is not often repeated for design goals or robot/game performance.	Does not show that the design process is repeated.
INNOVATION/ ORIGINALITY	Team shows evidence of independent inquiry from the beginning stages of their design process	Team shows evidence of independent inquiry for some elements of their design process	Team shows little to no evidence of independent inquiry in their design process
USEABILITY AND COMPLETENESS	Records the entire design and development process in such clarity and detail that the reader could recreate the project's history.	Records the design and development process completely but lacks sufficient detail	Lacks sufficient detail to understand the design process.
RECORD OF TEAM AND PROJECT MANAGEMENT	Provides a complete record of team and project assignments; team meeting notes including goals, decisions, and building/programming accomplishments; Design cycles are easily identified. Resource constraints including time and materials are noted throughout.	Records most of the information listed at the left. Level of detail is inconsistent, or some aspects are missing.	Does not record most of the information listed at the left. Not organized.
NOTEBOOK FORMAT	Five (5) points if the notebook has evidence that documentation was done in sequence with the design process. This can take the form of dated entries with the names of contributing students included and an overall system of organization. For example, numbered pages and a table of contents with entries organized for future reference.		ZERO POINTS (DOES NOT MEET CRITERIA) If awarding zero points, please include details in the "NOTES" area below.

The Engineering Notebook Judges' Rubric

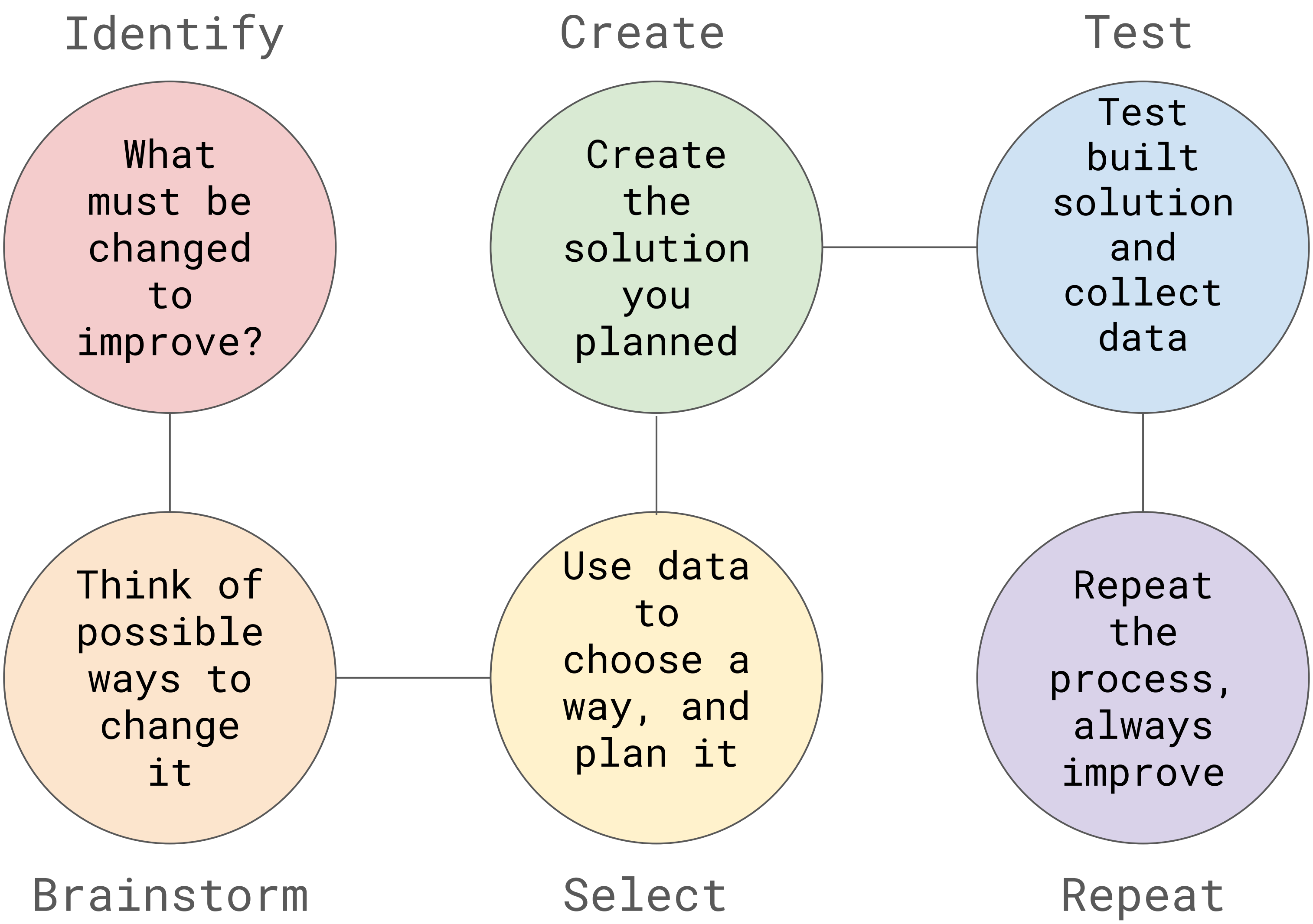
Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on:

The Engineering Design Process

An extremely important part of designing, improving, and learning about things, especially in engineering and in VEX, is understanding and implementing the Engineering Design Process.



We will use the engineering design process throughout the season, to help us create and improve an effective robot.

Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on: Pages 10-15

The Engineering Design Process

Identify

What must be changed to improve?

The first step in the 6-step variant of the Engineering Design process is generally Identify.

This means you need to identify a problem or area of the design (in this case, the robot/program) that could be improved.

As the first step in the process, it is arguably the most important, because there's always something in the design that can be improved. You just need to figure out what it is, then you can perform the rest of the process, and continue improving the performance of your design.

Examples:

- You realize that your lift is quite slow, and this is an issue
- You realize that your robot doesn't turn consistently during autonomous, and is messing it up

Continued on: Pages 11-15

The Engineering Design Process

Brainstorm

Think of possible ways to change it

The second step in the 6-step variant of the Engineering Design process is generally Brainstorm.

This means you need to take the problem or improvable area you have identified and think of ways to fix/improve it.

As the second step in the process, it directly follows the first. After identifying the issue, you need to think of ways to fix it. The rest of the process is built off of using these ideas you have come up with.

Examples:

- You think about how you could change the motor on your lift to make it faster, or make it lighter
- You learn about sensors and PID, Odometry, and other loops, and think you could use those to improve your turning consistency

Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on: Pages 12-15

The Engineering Design Process

Select

Use data to choose a way, and plan it

The third step in the 6-step variant of the Engineering Design process is generally Select.

This means you need to choose one or more of the solutions or improvements you brainstormed, and maybe test them to find the best.

The third step of the process, it marks the halfway point. Once you have brainstormed ideas, you need to systematically test and choose one or more, and figure out which is best for your situation.

Examples:

- You decide to make your lift lighter because it had better results and is more versatile
- You decide to make a PID loop with a sensor because it is simpler, easier, and more fitting for your situation than something like an odometry loop.

Continued on: Pages 13-15

The Engineering Design Process

Create

Create the solution you planned

The fourth step in the 6-step variant of the Engineering Design process is generally Create.

This means you need to build or create the solution(s) that you brainstormed and chose for the issue or imperfection you identified.

As the fourth step in the process, it is very important as you must actually create what you have been planning throughout the process, and finally begin to improve your design with it.

Examples:

- You remove/replace some of the metal on your lift to make it lighter as you had planned
- You add a sensor to your robot, then code each part of the PID loop you had planned to make your autonomous turning and movement consistent

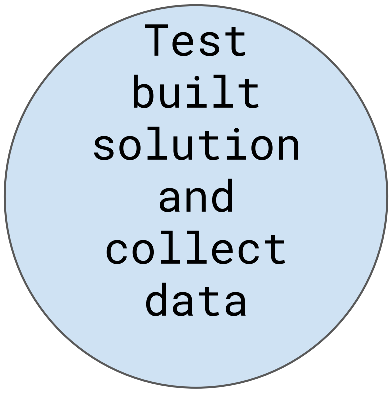
Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on: Pages 14-15

The Engineering Design Process

Test



The fifth step in the 6-step variant of the Engineering Design process is generally Test.

This means you need to test your creation that you made with the rest of the process, and see how well it works, and how it compares to the previous.

As the fifth step in the process, it is the final part of a cycle before it starts again. It means actually putting what you've made with the process in action, seeing if your creation works well, if it is better than it was previously, and if it was truly the best option.

Examples:

- You see that your lift is much faster now that it is lighter and not bogged down.
- With the loop implemented, your robot now turns much more consistently and has been improved.

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Contributors: ------- -------

Continued on: Page 15

The Engineering Design Process

Repeat

Repeat the process, always improve

The sixth and final step in the 6-step variant of the Engineering Design process is generally Repeat.

This means you need to repeat the process, which you should always do. You can always improve anything, even in the slightest. It's never perfect.

As the sixth and final step in the process, it is maybe the most important because it makes sure the cycle keeps going. You should always repeat the Engineering Design Process, always improving, always making things better. There will always be something to fix or change.

Examples:

- You realize that your robot might not be strong enough, so you begin the process again
- You realize that the code for your motors sometimes stops during a match, so you begin the process again

Date of Writing: 6/8/2024

Contributors: ------- -------

Continued on:

Documenting With The EDP

Documenting alongside the Engineering Design Process is important, so we can show that we have gone through these design cycles. The Notebook Judging Rubric (See pg.6) emphasizes this, saying that we have to show evidence that our design and documentation were made alongside the EDP.

How will we do this? Well, when we go through a cycle, we will explain what we did for each part with a page or part of a page. We will color code parts of pages/full pages that go over each part of a cycle, using the colors in pages 7-13 (see the colored bars at the top of those pages). For example, if we are making a page about how we are brainstorming solutions to inefficient drive-base design, it will be color coded as orange.

Documenting and designing using the EDP isn't just for points on the rubric, as it is a tried-and-true method of efficiently improving your design, and it is always good to have old data and information to fall back on later, so that you know exactly how you did something and why.

Date of Writing: 6/9/2024 Contributors: ------- ------- Continued on:

High Stakes: The Game

The game of High Stakes is interesting and intricate, and is unique especially to the games our team has participated in previously. (Spin Up and Over Under)

In the case that this is being viewed digitally, the link to the High Stakes game reveal video is here. This video explains the basics of the game, with some specifics on dimensions of certain parts and how to score points.

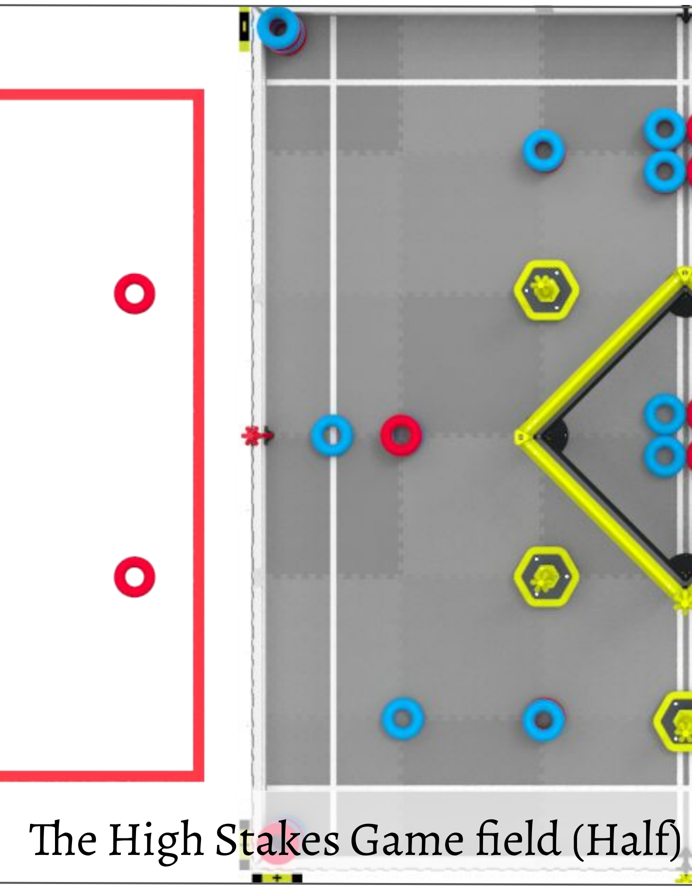
All the specifics, rules, and other important details like how to score Autonomous Win Points are explained in the Game Manual. We will go over parts of the game, especially rules and details from the manual, in the following pages.

According to the Game Manual, "The object of the game is to attain a higher score than the opposing Alliance by Scoring Rings on Stakes, Placing Mobile Goals, and Climbing at the end of the Match."

We will go over the game in multiple parts.

High Stakes: The Field

For space sake, I have taken half of the field as an image (below) rather than the whole field. The field is “mirrored” on each side, so this is fine and should get the point across. The half shown is the “red” side, containing half of everything.



The High Stakes Game field (Half)

According to the official Game manual, the field includes the following:

- 5 Mobile Goals, 1 Stake each
- 4 Wall Stakes, 2 Allied, 1 not
- 1 Ladder with 3 levels and one High Stake
- 48 rings, 24 of each color
- 4 Special Corners, 2 being Positive Corners, the other 2 being Negative Corners

As for scoring, there is the following:

- 6 point Autonomous bonus
- 1 point per ring scored on stake (3 if it is the Top Ring)
- Climbs grant 3 points at level 1, 6 at level 2, 12 at level 3
- Rings on stakes in the corner will have new values (pg.17)

Continued on: Page 19

High Stakes: The Field Pt.2

An important part of the field is the corners. There are Positive Corners and Negative corners. If a mobile goal carrying rings is placed onto a Positive corner, the point values for all rings on it will double. If it is placed on a Negative Corner, all rings on it will have opposite scoring, or will have their score multiplied by -1.

It is impossible within VEX rules to have negative points, so rings scored on a goal in the corner will be counted as 0, and will rather *take away* their original point values from your total score. While they are scored as 0, they have a net value of the opposite of what they were before. (Note that if you have 0 points, yet have rings on a Negative goal, you will remain at 0 points rather than going into a negative point range.)

Another thing to note about the field (specifically the stakes) is that each stake can only legally fit a certain number of rings. Mobile goal stakes can hold a total of 6 rings each. Wall stakes can hold a total of 2 rings each. The High Stake can only hold 1 ring. If additional rings are somehow squeezed on or set on top of a stake, they will not count.

Date of Writing: 6/9/2024 Contributors: ------- ------- Continued on:

High Stakes: Measurements

It is important to know the specific measurements of game elements so that the robot can be created to interact with them accurately.


A High Stakes Ring

The "rings" used in the game all have the following measurements:

- 7 inch outer diameter
- 3 inch diameter of "hole"in middle
- 2 inch thickness


A Mobile Goal

The mobile goals in the game all have the following measures:

- 10 inch maximal diameter (hexagonal)
- 14.5 inch total height (base & stake)
  No other measurements are explicitly listed in the manual, but will be tested later.


The Ladder

The "ladder" in the center is a 36x36x46 inch structure with rungs at 18, 32, and 46 inches respectively. No other measures for rungs or the High Stake are explicitly given, will be tested later.

Date of Writing: 6/10/2024

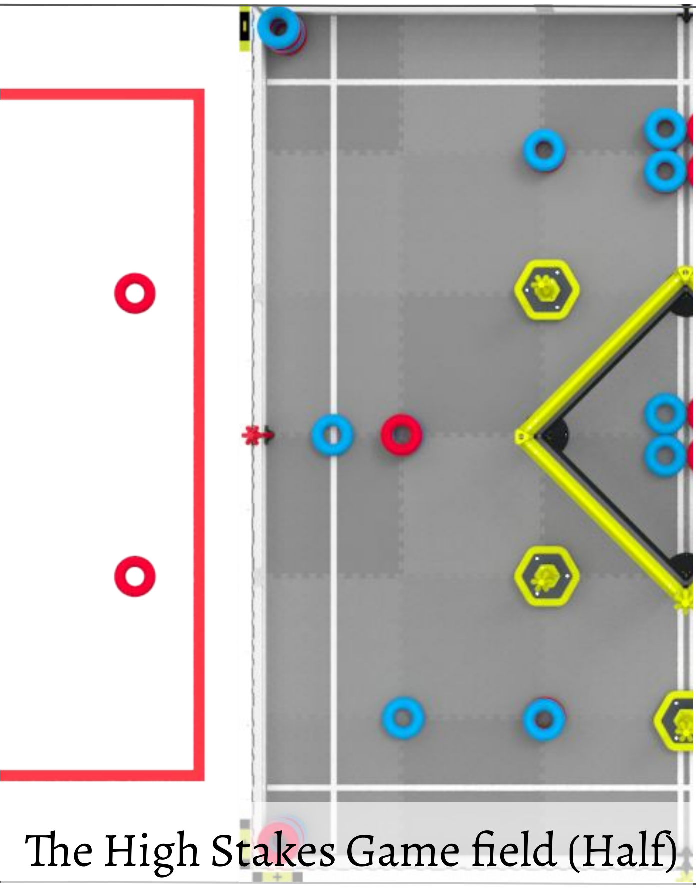
Contributors: ------- -------

Continued on:

High Stakes: Autonomous PT. 1

The autonomous period is an important part of the game. It occurs within the first 15 seconds of the match, and consists of completely autonomous movement, the robots moving purely from code and not from a controller. In High Stakes, there are many rules about Autonomous, unique parts of it, and a new Autonomous Win Point. I am using the half-field picture again to help explain autonomous plans, and how it works.

Also, to note, in High Stakes, the winning alliance of the autonomous period is granted 6 points. (In a tie, both get 3.)



The High Stakes Game field (Half)

All regular game rules apply during the autonomous period, but there is also a rule against crossing the Autonomous line, which is a pair of tape lines across the middle of the field. Any robot crossing it (touching any of the field on the other side of it) will result in that alliance's immediate loss. If both alliances do this, it will result in an autonomous tie.

Continued on: Page 22

High Stakes: Autonomous PT. 2

During the Autonomous period, you can score an Autonomous Win Point, which is functionally the same as a Win Point. (You get win points by winning Auton and matches.)

To score an Autonomous Win Point in High Stakes, your alliance must complete all four of the following tasks during the Autonomous Period. The tasks are:

1. Score at least three (3) rings
   - Place them on stakes

2. Have a minimum of two (2) stakes that have at least one (1) rings scored on them

3. Neither robot contacting/crossing/breaking the plane of the Starting Line

4. Complete the Autonomous period with at least one robot in contact with the Ladder

You must additionally not break any autonomous rules.

High Stakes: General Rules PT. 1

Within VEX, each game usually has a similar variation of the General Rules set. This is true for High Stakes as well. Here is part of the list general rules from the Game Manual:

G1 - Treat everyone with respect.
It’s common courtesy. Don’t be rude, don’t be mean.

G2 - V5RC is a student-centered program.
Don’t ask your teachers or parents to do everything.

G3 - Use Common Sense.
People can make mistakes. Don’t take them literally.

G4 - The robot must represent the skill level of the team.
No student can be effectively on two teams at once.

G5 - Robots begin the match in the starting volume.
Each robot must be smaller than 18”x18”x18” at the start.

G6 - Keep your robots together.
No intentional detachment/leaving on field of objects.

Date of Writing: 6/13/2024

Contributors: ------- -------

Continued on: Pages 24-25

High Stakes: General Rules PT. 2

Within VEX, each game usually has a similar variation of the General Rules set. This is true for High Stakes as well. Here is part of the list general rules from the Game Manual:

G7 - Don’t clamp your robot to the Field.
No intentional attaching/grasping of non-ladder field parts.

G8 - Only 3 Drive Team Members, only in Alliance Station.
Maximum of 3 Drive Team Members, do not exit station.

G9 - Hands out of the Field.
No making contact with field with body during a match.

G10 - Controllers must stay connected to the Field.
Connect controller to Field control system, do not unplug.

G11 - Autonomous means “no humans.”
Do not interact with the robot during Autonomous.

G12 - All rules still apply in the Autonomous Period.
Breaking rules during Autonomous will mean a loss of it.

Date of Writing: 6/13/2024

Contributors: ------- -------

Continued on: Page 25

High Stakes: General Rules PT. 3

Within VEX, each game usually has a similar variation of the General Rules set. This is true for High Stakes as well. Here is part of the list general rules from the Game Manual:

G13 - Don't destroy other robots.
No intentional destruction/damage/tipping over of robots.

G14 - Offensive robots get the "benefit of the doubt."
Unclear calls are decided in the favor of the "offender."

G15 - You can't force an opponent into a penalty.
No intentionally causing an opponent to break a rule.

G16 - No holding for more than a 5-count.
No intentionally trapping the opponent for over 5 seconds.

G17 - Use Scoring Objects to play the game.
Scoring Objects cannot be used to break rules that apply to robots. (Clamping, trapping, etc.)

Next, we will go over the ten (10) Game Specific Rules.

Date of Writing: 6/13/2024
Contributors: ------- -------
Continued on:

High Stakes: Game Rules PT. 1

While there are the general rules that apply to each game, each game has its own rules, including High Stakes. There are the Specific Game Rules, the Robot Rules, and the Skills Rules which are varied between each game. This and the next page will go over the Specific Game Rules.

SG1 - Starting A Match.

Robot must be placed before the match so that it is not touching any other robot, not touching scoring objects other than preloads, not touching or breaking the plane of their alliance's starting line, and not in motion.

SG2 - Horizontal expansion is limited.

The robot may not expand past 18”x24” during the match.

SG3 - Vertical expansion is limited.

The robot must never break the plane of more than 2 levels of the ladder at once, including the floor, no matter where it is.

SG4 - Keep Scoring Objects in the field.

No intentional removal of Scoring Objects from the field.

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Contributors: ------- -------

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High Stakes: Game Rules PT. 2

SG5 - Each Robot gets one Ring as a preload.
Each robot gets one ring, and it cannot touch another robot.

SG6 - Possession is limited to 2 Rings and 1 Mobile Goal.
A robot may not intentionally have possession of more than 2 rings and/or 1 mobile goal.

SG7 - Don't cross the Autonomous Line.
Robot may not break the plane of the Autonomous Line.

SG8 - Engage with the Autonomous Line at your own risk.
Be prepared for the event that opponents break rule SG7.

SG9 - Don't remove opponents from the Ladder.
Do not intentionally remove opponents from the Ladder.

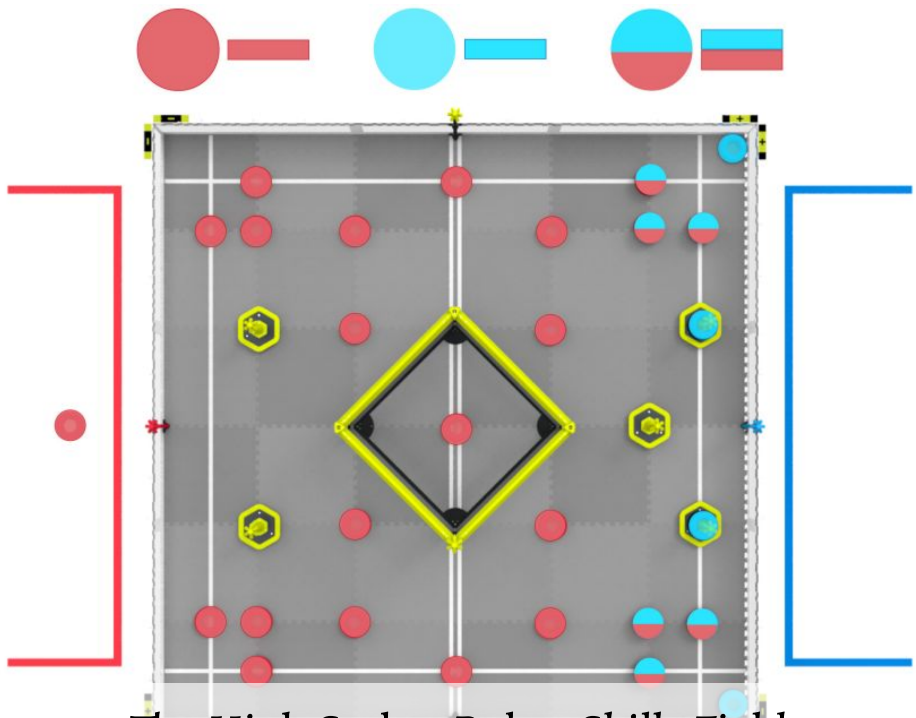
SG10 - Alliance Wall Stakes are protected.
No intentional interaction with other Alliance's Wall Stake.

The only remaining rules to go over are the Skills and Tournament rules. We have deemed the latter irrelevant, but the Skills rules will be gone over alongside Skills itself.

Date of Writing: 6/13/2024 Contributors: ------- ------- Continued on:

High Stakes Skills: Explanation

Each game has the Skills challenge, in which a robot is in the field on its own and must score as many points as it can within a minute while under a slightly altered ruleset. There is Driver Skills, in which the robot is driven throughout the duration, and Autonomous Skills, in which the robot is controlled entirely by a program.



The High Stakes Robot Skills Field

The Skills field is arranged like this, with an altered amount of rings and a rearranged set of field elements. Skills strategies need to be unique and efficient to score well with this new field.

There are some other intricacies such as teams being able to decide to stop early, by showing a Skills Stop Time. This does not alter scoring, but serves as a tiebreaker if needed. Otherwise, the run will be cut off immediately after one minute.

High Stakes Skills: Rules PT. 1

Skills has a special set of rules that make it work differently from a regular match. Here are the eight rules:

RSC1 - All regular rules apply unless stated otherwise.
Unless another rule says otherwise, all regular rules apply.

RSC2 - When you get to run Skills is determined by when you got into the line. Each team gets 3 Driver and 3 Autonomous runs.

RSC3 - Robots must start in a Red Alliance legal position.
Robots must start in a position legal to rule SG1.

RSC4 - Blue rings only score points if they are Top Rings, are the only Blue ring on the stake, and all Red rings are scored.

RSC5 - Any Red Ring scored above a Blue Ring has no value.
Any red ring scored above a Blue Ring on the same stake has no point value.

RSC6 - No ring gets Top Ring scoring if a ring on the stake has no value according to RSC4 or RSC5

Continued on: Page 30

High Stakes Skills: Rules PT. 2

RSC7 - No Corner Modifiers.

In Robot Skills, there are no modifiers for putting mobile goals in Positive or Negative corners.

RSC8 - Skills Fields are not required to have the same modifications as Competition fields.

If Competition Fields are modified, Skills Fields don't have to be, but participants should be informed, and, when possible, given access to Competition Fields for Skills if they would rather use those.

Those are the main eight rules for VEX: High Stakes' Robot Skills Challenge. They are scored like this:

- Each Ring scored on a Stake - 1 Point (see rules)
- Each Top Ring scored on a stake - 3 Points (see rules)
- Climb - Level 1 - 3 Points
- Climb - Level 2 - 6 Points
- Climb - Level 3 - 12 Points
- Mobile Goal Placed in a Corner - 5 Points (5 points are added to the score instead of modifiers in Skills.)

Date of Writing: 6/14/2024

Contributors: ------- -------

Continued on: 30

How a Tournament Works

A standard VEX tournament works as such.

Qualifier Matches:

There is a scoreboard ranking every team present on their performance in Qualifier matches, based on scored points, win points, and other details. The amount of matches is unclear, but they always have the standard of a 15 second autonomous period and a minute and 45 second driver control period.

Alliance Selection:

All teams present send a representative (the Captain) to line up first to last according to the team's ranking on the leaderboard. The top 16 teams may each choose another team to be their Alliance partner for the rest of the tournament. If a top 16 team chooses another top 16 team, the next team moves up and will be able to choose a partner.

The Tournament:

All 16 alliances that come out of the selection are put in a single-elimination bracket and all games are played until the finals. The winner wins the tournament. At certain large events, the Finals are a best of 3, rather than a single game.

Date of Writing: 6/16/2024

Contributors: ------- -------

Continued on:

Tournament Awards PT.1

Most VEX tournaments will offer several awards for the teams participating. Earning some awards is purely just for the honor, but some can qualify for state/regional events, and at some signature events and at state/regional events, they can qualify a team for Worlds. The main awards are as follows:

Excellence - Usually Qualifying

This award is granted to the top all around team in the event, in terms of both performance and judging.

Tournament Champions (2 recipients) - Usually Qualifying

This award is granted to the two teams who won the tournament finals.

Design - Usually Qualifying

This award is granted to the team that has been judged as having the most effective and efficient design process.

Robot Skills Champion - Usually Qualifying

This award is granted to the team that had the highest overall Robot Skills Challenge score.

Date of Writing: 6/16/2024

Contributors: ------- -------

Continued on: Pages 33-34

Tournament Awards PT.2

Continuing from the last page, the final "standard" award that will usually be present at all tournaments is:

Judges Award - Usually Not Qualifying

This award is granted to a team that the Judges have decided deserves special recognition.

There are some other performance awards that are common but do not appear at all events:

Tournament Finalist (2 Recipients) - Usually Not Qualifying

This award is granted to the teams that made it to the Finals, but lost.

Robot Skills 2nd and 3rd Place - Usually Not Qualifying

These awards are granted to the teams that had the second and third highest Skills scores respectively.

Tournament Semifinalist (4 Recipients) - Usually Not Qualifying

This award is granted to the teams that made it to the Semifinals, but lost.

Continued on: Page 34

Tournament Awards PT.3

The remaining awards are the Technical Judged Awards and the Other Judged Awards. The Other Judged Awards represent qualities of the team such as Sportsmanship, Energy, and Service, and while we will work to get them as well, they do not fit this list. The Technical Judged Awards are as follows:

Amaze - Usually Not Qualifying

This award is granted to a team with a top performing robot.

Think - Usually Not Qualifying

This award is granted to a team with impressive and effective autonomous programming.

Innovate - Usually Not Qualifying

This award is granted to a team with an innovative design.

Build - Usually Not Qualifying

This award is granted to a team with a well-crafted robot.

Create - Usually Not Qualifying

This award is granted to a team with a creative engineering solution.

VexForum and its Usage

There is an official VEX website, VexForum, in which people can ask questions and discuss things regarding rules, team establishment, ref calls, favorite moments, building strategies, and more. It is useful for many reasons and is also a way to connect with the VEX community.

We plan to be somewhat active within the VexForum via ------- -------'s account @soritarian1. This will allow us to learn many things, get strategies, understand rules and game components better, help others, and be a bigger part in the VEX community as a whole.

I (------- Z.) have already made quite a few posts, either asking questions or answering them, and it has helped a lot. It has solved inexplicable code errors, clarified rules, shown us some strategies and cool robot showcases, and we've even seen other teams that we have met in person on there.

We understand that using it may seem like we're going to copy other people on it, but we won't. We need to have a unique robot to follow the rules, learn, progress, and, in the sense of the game, maybe perform better than the rest.

Date of Writing: 6/28/2024

Contributors: ------- -------

Continued on:

Individual Studies: Build

Some of the most important parts of a robot and its' build are the drive-base, intake/collection system, and lift. Since our team has not gotten together yet (or been fully decided - our coach technically picks the teams) I wish to do an individual study with the knowledge I have and my experiences.

As a standard, I will go over as many regular designs as there are that I would find applicable and appropriate for this season, go over pros and cons, and decide which one I believe would theoretically work the best.

These "statistics", ideas, and decisions are not reflective of the team's efforts, as that is not possible at the moment, and tests are also not being actively taken for similar reasons. When our team is together, we will most likely do these studies again, but with input from all members, more information, and the possibility of running tests.

It is also important to note that I (at this point) have no direct experience with some of the build ideas that will be gone over, and will be using what I have witnessed in person and seen online.

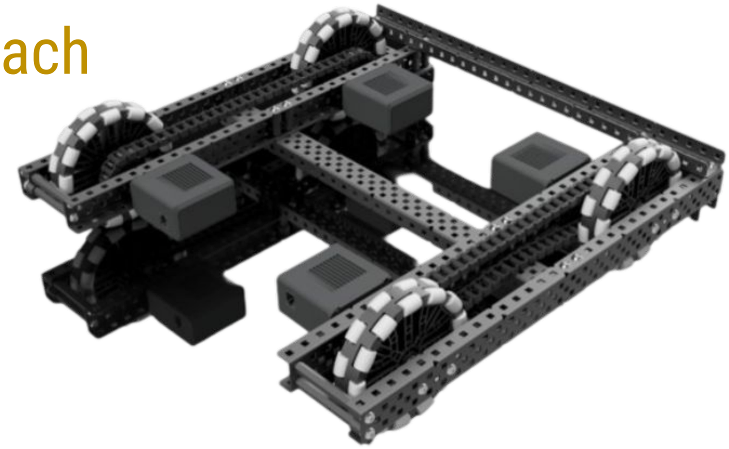
Continued on: Pages 37-38

Individual Studies: Drive-Base

The first set of possible choices I will go over are the options for our Drive-Base, or where our wheels and chassis go.

Option One: Standard "Tank Drive" (Omni-Wheels)

- Most common drive-base, often most reliable
- Versatile
- Two wheels on left and right each
- 2 way movement
- Decent turning
- Moderate strength
- Easy to push from the side



Option Two: Standard "Tank Drive" (Friction + Omni Wheels)

- Almost as common, reliable
- Versatile
- Two wheels on left and right each
- 2 way movement
- Moderate strength
- Rather bad turning

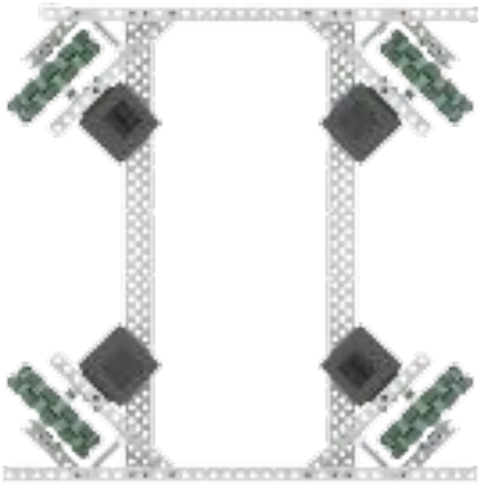
Continued on:
Page 38

Individual Studies: Drive-Base

The first set of possible choices I will go over are the options for our Drive-Base, or where our wheels and chassis go.

Option Three: “X-Drive” (Omni Wheels)

- 8-directional drive
- Great turning
- 4 wheels arranged on opposing sides of an octagonal base
- Weak, but hard to push
- Low strength
- Less versatile



Option Four: Mecanum Drive (Mecanum Wheels)

- Versatile
- 4-directional drive
- Hard to push
- Two wheels on left and right each
- 2 way movement
- Moderate strength
- Not that reliable
- Huge, clunky wheels

Date of Writing: 7/21/2024 Contributors: ------- ------- Continued on:

Season Updates: School Starts

My season has not officially started yet but our engineering and planning class and school has. Our team is pretty much together, and we can start planning and such. Our practices will start in a couple of weeks, and we can plan, test code, and maybe start building, so that we are ready for competitions in November or maybe December.

We're learning/relearning some stuff first, and I will probably go over some of this here, as the whole team will be getting this information at the same time.

From now on, "Individual Studies" will no longer be fully individual and will have some input from other team members, as to provide a wider view of some concepts and ideas, and to get an idea we all agree on, at least to start.

The first practice is on 9/17/24. Teams will (probably) be selected, as well as names, letters, and more, if possible. Let it be known that we are working in a room alongside several sophomores, juniors and seniors (we are freshmen.) We will not be "cross-teaming" during practices (as in making other teams help us.)

Date of Writing: 9/6/2024 Contributors: ------- ------- Continued on:

SEASON BEGINS (Practices)

Our season practices have begun. Our team is not fully clear, but as of now it will include myself (------- -------) as chief programmer and notebook lead, as well as ------- ------- as a designer and builder, ------- ------- as a builder and scout, and ------- ------- as a builder, utilitarian, and pit team. We may include a fifth member, though we are unsure at the moment. They will participate in the notebook, and they will be added to our team introduction page very soon.

Our practices are 2:30-6:30 PM on Tuesdays and Thursdays, with the first hour being not so much a practice as a planning period/free period, to make sure it is fair for the students who share our high school and the local community college, Tri-Rivers, who won't arrive until 3:30.

I will go into more detail about this as we go on, and I will get the team to make pages about themselves and some of their plans very soon. As of now, we are expected to go to 6 tournaments (excluding State and World, if applicable), with our home HS tournament and our home Blended tournament being guaranteed. We will also likely go to the Mount Vernon HS tournament, and a couple of others.

Date of Writing: 9/17/2024

Contributors: ------- -------

Continued on:

Season Beginning: Details PT.1

As stated, we will have practices every Tuesday and Thursday when possible from 3:30-6:30, with a 1-hour period beforehand for some planning and organization when needed.

We will also occasionally have Saturday practices at much longer times, but those will probably be smaller. I will not be present for the Thursday practice this week.

Our “guaranteed” tournament appearances are linked (from robotevents.com, a useful resource) if this is viewed digitally:

------- Holiday Blended Qualifier
------- HS Qualifier
Mt. Vernon HS Qualifier

A list of possible tournaments we may go to:

Dan Spak @ Firestone - Kennedy Group @ Brecksville-Broadview - West Holmes - Motion Control @ TSCC (Fremont) - Roller Coast RoboClash @ Cedar Point - Pioneer Blended @ Elyria - Marion Harding - Kalahari HS Open - Barnesville Blended - Washington CH Blended

Date of Writing: 9/17/2024

Contributors: ------- -------

Continued on: Page 42

Season Beginning: Details PT.2

Most likely we will go to these additional tournaments:

- Motion Control Robotics @ Terra S.C.C. (Fremont)
- Pioneer Classic Blended @ Elyria High School
- Washington CH Blended @ Washington CH High School

Our plan is, for the start, to have the whole team (primarily the builders) working on a starting robot design so we have something to begin building off of, while I record it in the notebook and collect some of their views and opinions of it. After a little bit, we'll start doing Engineering Design Process slides like previously, and at any practice I have a goal of 3 pages in the notebook, not including those from teammates. I will be doing most of it, being notebook lead.

Once there are enough parts of the robot set up, I will begin coding the parts/electronics of it and begin all the loops/functions/callbacks for driver control, and develop that as we go through. Once we have the robot fully set up, or at least a base, I will begin autonomous programming with a goal of winning an autonomous win point over else unless a better option suddenly comes up.

Date of Writing: 9/17/2024

Contributors: ------- -------

Continued on:

Post-Practice Notes 9/17/24

Our first practice was completed last night, and here are some notes and plans regarding the outcome of the practice and what will happen now:

- ------- ------- most likely joining team

  ------- will be an assistant builder and designer, and most likely will work as a scout, and if applicable, match loader. He will have notebook input as will the rest of the team. However, as teams have not been finalized, there is a chance he does not join us.

- I will not be present next practice.

  I may have the rest of the team fill in for notebook duty during it, and finalize their pages later so that we can get a view of everything I may have missed.

- Robot designing has begun.

  All we have so far is a rough sketch of half of our drivebase, and we will go into much more detail based on our research/tests/results and also probably insert photos of our first sketches.

Post-Practice Notes 9/19/24

I was not present for the 9/20/24 practice, and my teammates were unable to work on the notebook due to other circumstances, and have asked me to make this summary.

We drew up and tried to submit multiple designs and strategies to our coach, but they were denied and we were sent back to the drawing board. A full design has not yet been made because of this, and we will work on it at the next practice, which is one of few Saturday practices and will take place on 9/21/2024, where we may also start building. I will document this process as well as I can, and maybe start documenting an Engineering Design Process design cycle.

We're using inspiration for a clamp from a robot reveal video on YouTube, and we may use others for inspiration for other parts, but we will have our robot be unique and we aren't going to simply copy another robot.

We've decided on an 8-wheel, 6 motor drive with 360 rpm geared motors. This will mean a very strong, large base, which will be hard to push, and will have mobility and strength advantage over most opponents.

Date of Writing: 9/20/2024 Contributors: ------- ------- Continued on:

Practice Goals/Plan: 9/21/2024

For today's practice, we have the following goals:

- Get an approved design with our coach
- If the above goal is fulfilled, begin building
- Finish an Engineering Design Process cycle
- Document the cycle

We will also have finally submitted our finalized tournament list, as some things have changed outside of our control. This includes not being able to attend Kalahari US Open due to other ------- teams taking up our slots for it, which we could not apply for as ------- was not a finalized member of the team yet. (But now that he is, we can get spots for other ones.)

Since today's practice is a 4 hour morning practice, things will probably go differently, but the plan is to finish a basic sketch design, submit it, and then we can create it and test it, then repeat the design process for each part of the robot. I will try to fully document this process as best I can whenever it happens, with the proper color codes I set up previously.

At the time of writing, the practice has literally just started, and only ------- has gotten here, so I am just writing this for now.

Date of Writing: 9/21/2024

Contributors: ------- -------

Continued on:

Updated About Us Pages

We have made more, and more detailed About Us pages, editing the original 6/8/24 Page 5 and adding a new page 6 and 7, changing every single page number in the corners, "continued on" bits, and the entire table of contents, so that it can be shown towards the start of the book as many are, so that one can understand our individual experiences in robotics and some other aspects. This proved an organizational challenge, but it has worked, and now the notebook is better for it.

At the time of writing this, only ------- and ------- have written their parts, but the others will come soon, and will almost certainly be there by the time anyone is reading this.

Additionally, some starting pages have been reformatted and edited to more fit the organization and style of the rest of the book, and to be more clear and efficient at conveying the necessary information, while also looking cleaner and more uniform both in general and to the rest of the book.

More of these changes will likely be made soon, and they will be mentioned when they are, to improve overall clarity.

Date of Writing: 9/21/2024

Contributors: ------- -------

Continued on:

Beginning Process Summary

Our initial first run of the Engineering Design Process was not fully documented, but it was shorter than usual due to the circumstances of starting the season. As a summary:

- Identify

Our problem was that we had no robot, and we needed an effective robot to play High Stakes, but to do that first we needed a drive base.

- Brainstorm

Together the team brainstormed different ideas and potential drive base ideas, even incorporating the Individual Studies, and we narrowed it down to a 6-wheel omni drive, an 8 wheel (6 motor) omni drive, and a 4-wheel mecanum drive.

- Select

After thinking about and discussing all the pros and cons, we eventually decided on an 8 wheel, 6 motor omni-wheel drive, with blue motors (600 rpm) geared down to 360 rpm to guarantee maximum strength, as well as a decent amount of speed.

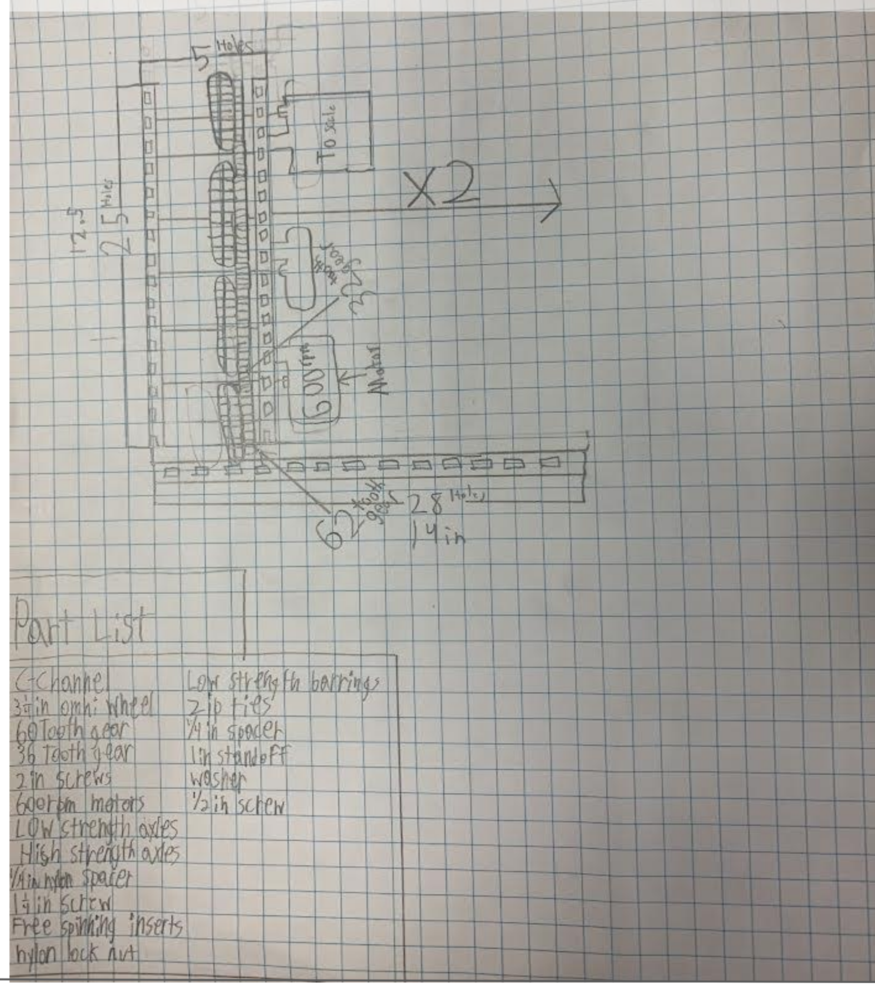
On the next pages we will go over the rest of the process in more detail, as it is active. We are building as I write this.

Date of Writing: 9/21/2024 Contributors: ------- ------- Continued on:

Drive-Base Initial - Create/Build

As the first parts of the Drive Base design process were summarized in the last page, it is now time to document the Create part of the process, where we build the first base.

Pictured here is the first design sketch of the drive base, showing some details as well as a parts list we will use to build. First, we prepared the wheels by screwing gears to them so that they can be geared up more accurately and easily once they are on the base itself. Then, we fitted the wheels to the metal base halves, evenly spaced.



A scale drawing of our base plan + part list

For attaching the wheels to the base, we used bearings with zip-ties (see why on page 49) and then we started making the connections for the base that goes around the wheels go.

The Zip-Tie Attachment Method

When attaching wheels and gears and such on driveshafts to our base, we, instead of the standard 3-hole bearing with a screw and nut in each of the empty holes alongside the driveshaft hole, we put in zip-ties.

We have done this previously, and have discovered multiple reasons why it works, and in experience, it definitely has.

- Lighter Robot

Even if the amount is tiny, this lowers the weight of the robot and drivebase, making it just that slightest bit faster.

- Easier to work with

Zip-ties are much easier to work with in this case, because they are faster to put in, and, when deconstructing so that the robot can be worked with, or destroyed post-season, instead of going through all the unscrewing, you can just clip the ties.

- Sturdiness

Zip-ties are far more sturdy than they seem, and are more consistent than screws, as they can't fall out, can't unscrew themselves, and are simpler.

- Budget

Simple. Zip-ties are far cheaper than screws + nuts.

Date of Writing: 9/21/2024 | Contributors: ------- ------- | Continued on:

Beginning Coding Process

I've also begun the basic coding process - I'm new to V5 Pro, and have been learning some of it on the spot, but it is working. The image at the bottom does not include everything, of course, just the declarations of our electronics. We are taught to do them directly like this, typing them out manually, rather than through the electronics menu. This gives us more customization, and also helps teach us code for the future.

The rest of the code is in the competition format, and all the includes and such are there, as well as code for controller axes, and at the moment, running this code would allow a robot of our planned size with our planned 6 motor base, to drive and turn with a split arcade controller drive, just as intended.

```
brain Brain;
controller Controller;
motor LF = motor(PORT13, ratio6_1, true);
motor LM = motor(PORT2, ratio6_1, true);
motor LB = motor(PORT14, ratio6_1, true);
motor RF = motor(PORT18, ratio6_1);
motor RM = motor(PORT5, ratio6_1);
motor RB = motor(PORT19, ratio6_1);
digital_out clamp = digital_out(Brain.ThreeWirePort.A);
motor_group LeftDrive = motor_group (LF, LM, LB);
motor_group RightDrive = motor_group (RF, RM, RB);
drivetrain Drivetrain = drivetrain(LeftDrive, RightDrive, 10.21017, 14, 15, inches, 0.6);

competition Competition;
```

The current declarations in our code for High Stakes on VEX V5 Pro.

Post-Practice Notes - 9/21/24

Attendance:

- ------- was not present
- ------- was not present
- ------- was late slightly (30 minutes)
- ------- & ------- present entire practice (4 hours)

Since ------- and ------- were not there, we could not build very efficiently, so we did not make much. I focused on reorganizing the notebook, and writing a couple extra pages based on the start of our processes.

------- and ------- worked on the drive-base build process explained during that practice's pages. At the moment, it is at a point where it should be able to be completed in the next practice if the whole team is present. That is also the likely goal for the next practice.

Planned attendance for the next practice is full at the moment, though this may change. I will now start listing attendance on every post-practice page, and will make one after every practice from now on. The next practice is on 9/24/24.

Practice Goals/Plan 9/24/24

Our practice has started for today. ------- is not here, and he has an important football practice, so he is not able to come. Otherwise, attendance is full, except that I will be leaving an hour early (5:30, practice ends at 6:30) for a family event.

Practice plans:

- Complete drivebase, with help of ------- now that he is here
- Start preparing electronics, so that we can test driving
- Document rest of drivebase engineering design process
- Start designing next robot parts (lift, clamp, etc)

Our basic code is completed, there doesn't seem to be any more I can do at the moment without being able to test with the bot. At the moment, it includes what is in page 50, plus a little more. (Split-Arcade drive for 6 motor, 8 wheel drive, as well as a clamp and lift, and competition-formatting.)

I have realized that it is very important to show how we use our time, and since we now have a few practices' experience, I will use one of the next pages to make a Gantt chart of our time distribution, as well as some additional details as to how we spend our practice time.

Season Schedule Update

We have received a finalized update to our season schedule. It is shown at the bottom of the page. We are going to six tournaments, being Motion Control Robotics, ------- Blended Holiday, Mt. Vernon, Elyria (Pioneer Classic Blended), Washington CH Blended, and the ------- HS tournament. At the end of the list is the ------- MS tournament, which our club requires us to work at as scorers, field assemblers, managers, and more. This helps us develop a better understanding of the game, and also allows us to understand what the tournament workers are doing at our tournaments, so we know how to respect them and their schedules.

This is our tournament schedule for High Stakes, plus one we are working at.

6978B

Event	Location	Date	Leave HHS (estimated)	Back to HHS (approximated)
Motion Control Robotics	Terra S.C.C. (Fremont)	Sat, Dec. 7	6:00am	7:00pm
Highland Blended Holiday	Highland	Sat, Dec. 14	Not Leaving	All Day!
Mt. Vernon	Mt. Vernon HS	Sat, Jan. 4	7:30am	5:00pm
Pioneer Classic Blended	Elyria H.S. P.A.C.	Fri, Jan. 10	1:30pm	Midnight
Washington CH (Blended)	Washington CH HS	Sat, Feb. 1	5:45am	7:30pm
Highland HS	Highland HS	Sat, Feb. 8	Not Leaving	All Day!
Highland MS	Highland MS (working)	Sat, Feb. 15	Not Leaving	All Day!

Date of Writing: 9/24/2024

Contributors: ------- -------

Continued on: 53

Our Time Distribution Plan

We initially planned to use a Gantt chart to display this and convey how we want to distribute our time, however we could not find a sufficient way to insert one or an alternative chart that would fit our needs, so we made a rudimentary “chart.”

------- (Notebook Lead & Head Programmer)

3:30 Recap, plan, and other pages **4:30** Test autonomous or new electronics code if possible **5:30** Finishing pages, process documentation until **6:30** (Before events, extra coding time)

------- (Captain, Builder, Designer, Strategy)

3:30 Planning + Begin building **4:30** Help test code, assist teammates **6:00** Finish building and clean up. (Before events, extra drive practice time)

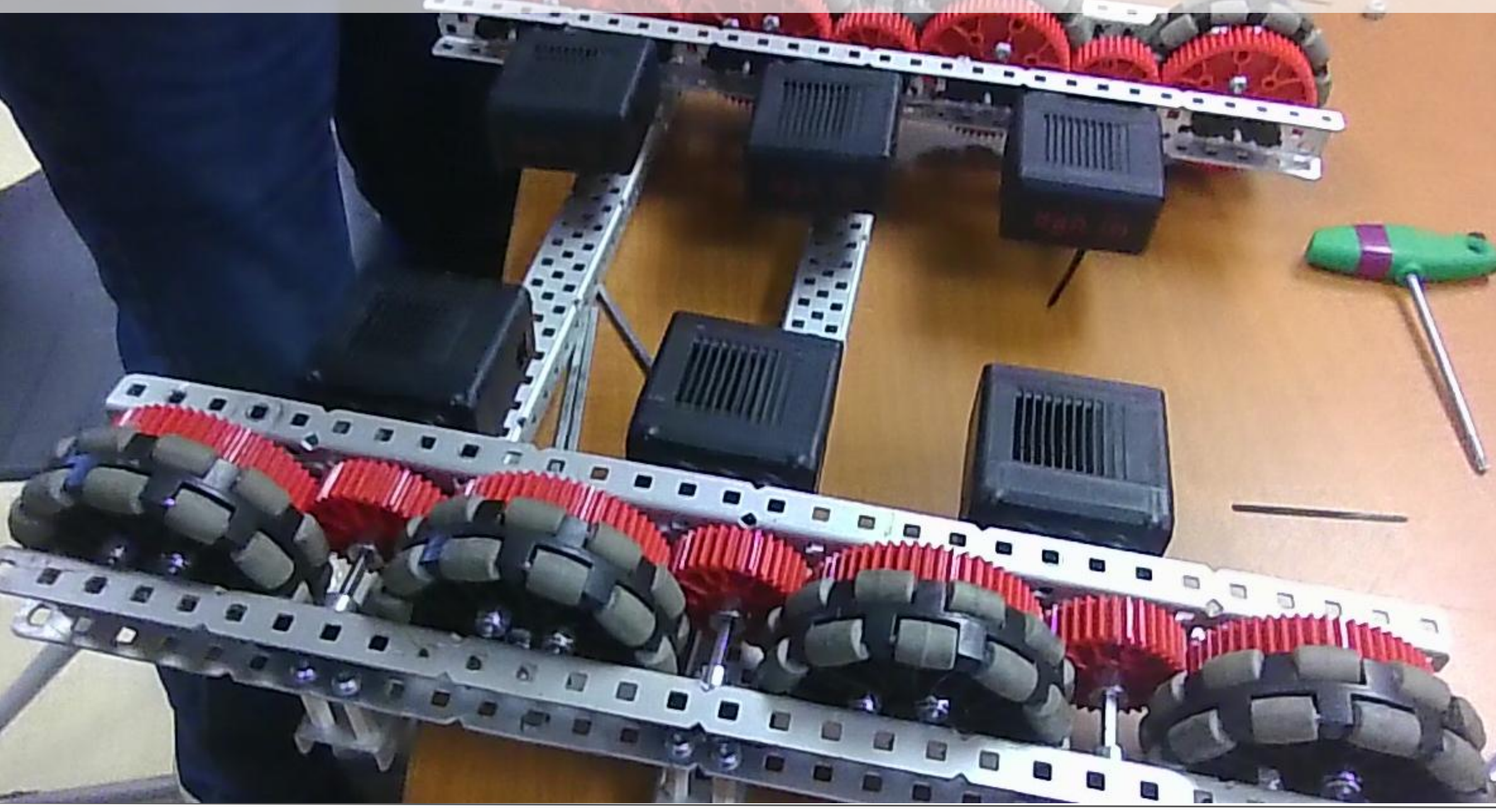
------- & ------- & ------- (Build, Strategy, Utility)

3:30 Build planning, gathering materials and such **4:30** Focus on build and some testing when applicable **5:30** Assist code tests, do match-loading and backup driving practice. **6:00** Final tests, relay information, finish building and clean up. (Before events, troubleshoot robot and find possible problems)

Drive-Base Initial Build - Part 2

Pictured at the bottom is an image of our now-finished (for now) drive base. Continuing from the events on page 48, we finished assembling each identical half of the base, used 2 c-channels to connect them, and then attached the in-between gears (making a 60-36 ratio with the blue motors, final RPM being 360) and then finally the motors on those smaller gears. The drive-base build is complete, and has the dimensions of ~15” x ~15”. The wheel base (center of left wheels to center of right) is 12.5”. We will show our tests when we attach a brain.

Our drive-base as of now - 8 omni-wheels, 6 motors geared to 360 RPM.



Date of Writing: 9/24/2024

Contributors: ------- -------

Continued on:

Additional Practice Building

At today's practice, after the drive-base was completed, we began building some smaller next components and parts, including a sled concept, the sides/borders for our intake, a clamp concept, and we also tightened the robot and attached the intake side-parts. We also started planning the intake spot, as well as where we will be mounting the brain, radio, and wires/other electronics.

More is to be done and will be documented later, as I will not be here to witness and document all of it, as I am leaving early as stated in this practice's intro page. Teammates will fill in the rest:

After ------- left, we finished the intake arm that is now mounted on the front connected to the two side parts we put on. We added an additional bar to the middle to make the structure more sound, and we added two vertical bars to put the rest of the intake and the lift on next. - -------

We want to work on the intake more now, and we may be able to finish it next practice, and then move on to the other mechanisms. - -------

Date of Writing: 9/24/2024

Contributors: NZ, MB, EC

Continued on:

Post-Practice Notes - 9/24/24

Attendance:

- ------- not present
- ------- left early
- -------, -------, and ------- present all practice

------- had another football practice, but he will be able to show up to practices again soon. Since 4 of us were present anyway, we were able to make more progress than we could without ------- as well and ------- coming late. We got the drive-base done, as well as the starts of some other builds (particularly the intake) and their individual designs. Now that there is a tournament schedule, we will do some more research and get some more information about them so that we can make plans for each one.

Otherwise, we should have full attendance next practice, as I know that I will not be having any reason to leave, and my teammates will not have anything else in the way, as it is a special practice that is from 5:00 to 8:00 rather than 3:30 to 6:30, which also means that some things will be organized differently, and we will not have the 1-hour planning phase beforehand as usual.

Date of Writing: 9/25/2024 | Contributors: ------- ------- | Continued on:

Practice Goals/Plan 9/26/24

This practice is organized differently due to schedule conflicts with the coach and some students, and is placed from 5:00 PM to 8:00 PM rather than the usual 3:30 to 6:30. The entire team is present, except -------, who will show up later.

Practice plans:

- Complete intake, a team effort with the builders
- Figure out electronics mounting plan
- Begin placing lift specifications based on possible clashes with the intake placement
- Run basic intake tests, proof of concept and such

Football practices should soon not get in the way of a lot of robotics practices, so ------- and some other football players should be able to show up more often and do more. This will mean that we will be able to get stuff done faster, and also get additional input from ------- who might end up doing some notebook work with a builder's perspective.

Update: ------- has arrived (30 minutes late) and will assist building, so the process should go faster and he will likely be able to write a page or two at today's practice.

Date of Writing: 9/26/2024 | Contributors: ------- ------- | Continued on:

Initial Intake Design Process

As some of the intake's design process was missed so far in the notebook, it will be summarized similarly to how it has been before, where the first three steps were done in one page.

Identify: We need an effective intake for picking up the rings and placing them in clamped mobile goals.

This one's much clearer and obvious, as will all initial "identify" sections will, as our issue is that we don't have one.

Brainstorm: We thought of several ideas based on robot reveals we've seen, and our previous experience with intakes.

We took material ideas from VexForum, YouTube, our sister teams, and even just previous yearly experience, as we know what works with field element materials, like the OU tri-balls.

Select: After going through all our ideas, we eventually decided on a flex-wheel floating intake that goes upward.

We realized that this was the best option, as it worked very well for us in Over Under, and many good teams use it this year.

Initial Intake - Build/Create

With the start of the process summarized, the build can now be explained as it goes. Firstly, as we finished the drive-base last practice, we made small side parts for the intake to be attached to, in the form of very short bars coming out of the front, on the inner edge of each part of the base.

At the end of last practice and at the start of this practice, we made a roller part with a high strength driveshaft with six light gray (squishier) mini flex-wheels. We added a small bar above them to prevent damage, and then put the edges of the driveshaft into two more smaller bars via drilled bearings, and attached them to the short mounted bars we added previously.

We spread out the flex wheels evenly along the driveshaft with spacers between them, and between a couple of them we added smaller sprockets to chain it to the motor we will set up. It is a “floating” intake because the bars from the intake are connected to the mounted bars via regular driveshafts, rather than being static. This makes it smaller, which is good for size-checks on large robots, but also more dynamic, being able to pick up in different situations and more effectively. We put in a slanted polycarbonate piece, and the lower intake is done.

Date of Writing: 9/26/2024 Contributors: ------- ------- Continued on:

Code Progress + Plans

There's a limit as to what I can do with the code right now, as the brain and wires and such are not connected yet, however the basic code, declarations, and all sorts of comment blocks have been finished, with all the specifics we have so far, and helpful blocks to assist with organization and to use if I am not present to understand the code.

Since I cannot work on other stuff, I will continue on my PID research I started and worked on last year. PID is short for Proportional, Integral, Derivative, and is used to make hyper-accurate and self-correcting autonomous runs, and sometimes even assists with driving in some situations. It is complicated and difficult to do, and I was only able to make a P loop last year. It will be explained in a later page, as best I can.

I do not fully understand it yet, nor will I be able to test that, so that probably will not be for a while. Here is a useful document that explains how it works, and while I believe I understand the concept and how it works, I have no clue how to implement it into code and nothing I have tried has worked. Here is the link, if being viewed digitally: George Gillard PID Document (Download Here)

Date of Writing: 9/26/2024

Contributors: ------- -------

Continued on:

Post-Practice Notes 9/26/24

Attendance:

- ------- late by about 90 minutes
- -------, -------, -------, ------- all present for entire practice

We made a good amount of progress this practice, with quite a bit of building, new design ideas, and notebook progress from multiple team members. ------- wrote his introduction, ------- finished his, and multiple full pages were made. We built and nearly finished our intake, and made progress on the rest of the build, specifically the lift and clamp. We have had clamp designs prepared, and the existing items will be tested. Of course, they can't be until we get a brain mounted and electronics set up, which will most likely be done during the next practice, unless something comes up.

Except for -------, we should once again have full attendance, and we will do more planning, especially for tournaments and how we will set them up. We might discuss how we will do scouting and such, and our alliance selection criteria. We will also do our same, regular building, notebooking, and possibly testing if we get the brain ready. Our practice will be another normal one (3:30 - 6:30) as regular.

Date of Writing: 9/30/2024
Contributors: ------- -------
Continued on:

Practice Goals/Plan 10/1/24

Today's practice is back to normal. -------, -------, -------, and ------- showed up on time, ------- has not arrived yet. As usual, the team is focusing on building while I develop the book and the program, particularly current PID research I am doing.

Practice plans:

- Finishing touches on Drive Base
- Finishing touches on lower intake
- Progress on lift
- Mount brain, wire motors and such and find ports
- If possible, code research and testing with robot

This practice is going to be a normal one, there is not too much to report about schedules or structures. I will document what happens here, and finish getting the introductions from my teammates, who are doing it later as they are busy building and discussing design ideas. I will be doing more research on P / PID loops and their effects, and so far I believe I have figured out how to make a basic P drive loop. Next I will be looking at a turning loop, though I might have to go back to scratch as I do not know if they would work as I am not able to test on the robot yet, though I should soon, maybe today.

The Upper Intake / Lift - Design

Identify: We require an efficient way to carry rings from our lower intake to the peak of our robot, where we can drop them onto a clamped goal.

We don't have one yet, so there's no existing one to change, but this one is more clear.

Brainstorm: We together thought up a collection of possible solutions, and since we already had a bar, this was mostly about the shape of the track carrying it up. The options were tank-chains or regular chains, and then what we would use to "carry" the disc (like a hook for it to stay on as it went up), and then the drop-off method.

Select: We thought about it and gauged the merits, and after talking about it, testing miniature prototypes, and more, we decided on a regular chain for speed and a polycarbonate hook for keeping on the disc on a size we can change, and also because it looks more unique and shows proof of our robot being our own.

We have already started building it, and will this practice.

Date of Writing: 10/1/2024

Contributors: ------- -------

Continued on:

Initial Lift - Build/Create

Our lift build has been in progress for quite some time, and has been focused on by my teammates during this practice. The initial lift / upper intake bars were placed as soon as the drive base was complete, so as to gauge where the initial intake would be and where it would connect with the lift.

We now have a second set of bars with the lift motor, a driveshaft, and the red sprockets, and we have set up the driveshaft and accompanying sprockets for the upper bars, as well as the chain we have created with the hook we chose in the previous page to ferry the rings up to the top of the robot to drop them into a theoretical clamped goal that we would have attached. The chain is ready, but not on yet, for other reasons.

Code Research - PID

Today my main focus was research on more in-depth code ideas and strategies, and most importantly and particularly, more concepts of implementation of Proportional, Integral and Derivative loops for autonomous. I've done tons of research on VexForum, various documents like George Gillard's, and sites like the Ascend Robotics site which has more of a guide.

While I could have just taken code, the point is to learn, not to copy others. I believe I have taught myself how to make my own style of P loop, and I am working on turning that into a PI and then PID loop once I am able to test the first one when our robot is ready. For the concept, here's my explanation, inspired by the Ascend individual part explanations.

PID stands for Proportional, Integral, Derivative. Proportional helps your motors based on present data. Integral helps them based on past data. Derivative helps them based on predicted future data. They use all these things to more accurately slow down the robot before it reaches its goal to prevent overshooting / fishtailing (P), to prevent undershooting and stalling (I), and to prevent overshooting or errors (D). It is incredibly good and useful for making an effective auton.

Post-Practice Notes 10/1/24

Attendance:

- -------, -------, -------, ------- all present entire practice
- ------- did not come to the practice

There was good progress this practice in multiple areas. We finished the intake + chain + hook base, we prepared plans to improve it, and I did extensive research on PID, how it works, and how to code it, and finally figured out how to actually do it. We also put a back bar on for the clamp to be attached to, and we slightly adjusted the lower intake so that it picks up better and transitions to the lift / upper intake better.

The notebook had its regular updates, but some things will be changing soon as for how it is structured and how it will be written from now on. On another note, our coach announced that we will have the ability to take robots home to work on them soon - on the conditions that the team has an average of 15 hours of practice (so far, more soon scaling with practices), have shown progress, document planned changes beforehand, and have every team member agree to what will happen and sign a form that will be turned in to the coach. We already have a form filled out, and might take the robot home very soon.

Date of Writing: 10/3/2024 | Contributors: ------- ------- | Continued on:

Practice Goals/Plan 10/3/24

Another normal 3:30-6:30 practice. -------, -------, -------, and ------- showed up on time. ------- is not here and may not show up once again. We are, as usual, focusing on building while I work on documentation and code research. In the meantime, however, I might pull teammates to work on their own pages to document their experiences, so we can get a better view.

Practice Plans:

- Make diagonal bars on Upper Intake/Lift
- Attach full chain to the lift
- Replace top intake driveshaft with high-strength
- Prepare robot to be taken home if possible
- Prepare brain mounting
- Start making team "pamphlet" for interviews

Another normal practice, however the room layout was moved. Tables have moved and the field was moved, and is now better prepared for driving practice, however we still do not have a brain and such mounted. The upper intake is being finished first, then it should be mounted so that we can test everything, post more engineering design process pages, and start new processes.

Date of Writing: 10/3/2024

Contributors: ------- -------

Continued on:

Build Continuation - Intake

Due to having to focus on some small fixes and ------- not being present, we have not been able to accomplish much this practice, however we have worked on and done the intake transition area. We set up bars with diagonal connectors on both sides, and set up a motor between them. The necessary driveshafts were replaced with high-strength ones so as to prevent bending and to increase general intake strength.

The bars are now ready for the rest of the intake and the transition zone to be imported onto them. At the moment, the way the intake works is that it picks up rings and bounces to accommodate the situation. Then, the hook from the upper part comes around and grabs the ring, and brings it up, then due to how the hook is angled, slams it down, meaning that it should go on goals effectively. We have not received field elements other than the singular ring yet, so we can not do testing, however we do have a 3D printed goal that needs to be worked on and filed, and it should be ready by the time we have motors for the intake set up and connected to the brain.

We also moved some gears to fix minor issues with the lower intake. It now works fine, and we will stick with it.

Date of Writing: 10/3/2024

Contributors: ------- -------

Continued on:

Notebook & Presentation Ideas

After looking at many other examples, talking to sister teams, and seeing official and unofficial resources, I think that the current notebook formatting might not be the most efficient or effective way to display our process for designing, building, and testing the robot, code, and other related items. I will be going over a few ideas that might show up in the coming pages, to improve the book as much as possible, as well as some other plans and ideas for interviews and presentations.

Idea 1: The Pamphlet

One idea that we will almost certainly go with, we want to make a pamphlet and “cards” for our team. We got the idea from our former senior team, who did it to great success, so we want to put our own spin on it and make ours unique.

The idea is to make a 3-5 page foldable pamphlet that shows pictures of our robot and specific mechanisms, has other details like robot size and motor RPMS, has introductions and information about the team members, and more. The purpose of this is to give it to judges during interviews for them to see and understand our ideas. We will also give it to scouts to show why we would be a good pick for alliance selection.

 Continued on: Page 71

Notebook & Presentation Ideas

Idea 2: More Tables

One notebook specific idea is to use more tables to convey changes and such and to document the engineering design process. This is often more clear, and shows more proof of our use of design matrices and rating/testing our different ideas when choosing them.

However, the reason we haven't used them yet is because they have the downside of being very clunky and not fitting in the book well. Additionally, Google Slides (where this book was made) has a limited selection of different types of graphs and charts, and a lot of them aren't what we want or need.

Idea 3: Prioritize Design Process

A thought that we have is to prioritize and categorize everything into the design process categories. This would mean putting every page into a different category - like this, for example, would be a Brainstorming page.

This would mean that all pages would have the colored bars - it could show more proof of our more discreet usage of the process, but could also undermine the more literal usages.

Date of Writing: 10/3/2024 Contributors: ------- ------- Continued on:

First Intake Completion + Test

After putting together all the new stuff for the intake, it is almost completely finished besides some finishing touches and slight tweaks that may be needed. Even though we do not have a brain mounted, we took an extra one and connected it to a motor, and used my code to run the intake / lift parts. They work perfectly fine and well, and the idea that while depositing the ring the intake hook slams it onto the goal seems to work, though the angle is a bit off. We do have plans and solutions for this, though, like making the clamp tilt the goal towards the robot more. This will all be done very soon.

The crude tests did work well, but there can be much improvement. We might make the chain fuller, and we are almost definitely adding more hooks, as we only have 1 but could probably have 3 or 4 to increase the speed of the intaking and the consistency.

We tried to get a picture for this page, but it was lost.

Post-Practice Notes 10/3/24

Attendance:

- -------, -------, -------, ------- all present entire practice
- ------- arrived 1 and a half hours late (5:00)

Once again, a 3:30-6:30 practice. We made the same progress we were working on, though it was a bit slower due to certain circumstances. I took the time to make some pages about some possible notebook development. Things will change a lot in the notebook after we finish the base robot, which should be soon, as the pages will be almost purely design processes and tournament results, as well as the practice intro and outro pages.

After discussing with our coach, we have decided to let ------- take the robot home and work on it, alongside some input from the rest of us, as the coach has allowed us because we have sufficient hours and experience, have been productive as much as possible at practices, and will be filling all the criteria. One of which is making a page about the plans for this time, and then making pages for what happened and all the details about it that I have. The following pages will cover that once there has been significant development in the robot.

Date of Writing: 10/5/2024

Contributors: ------- -------

Continued on:

Robot Take-Home #1 Plans

This will be the first time this season that the robot will be leaving our school building, and the first time it will be worked on outside of a practice. It will be brought to -------'s house, and he will work on it with some input from the builders this weekend, and details and information will be relayed. The plans for this weekend are as follows:

- Finish clamp for the goal

It's been in the works for a while, it just needs to be attached and tweaked slightly to tilt the goal due to the intake position

- Mount brain, battery, and radio

This is all fully necessary for making the robot run, and this will mean we can finally test things like autonomous and velocities.

- Tweak intake/lift

Due to the way it is positioned, after some basic tests (not enough to be documented, mostly happened by using our hands to push it, not a brain / motors) the rings can get blocked, so we are extending it and making the chain and track longer. It will make it more accurate and easier to work with

- Identify any issues with the previous systems to see if any additional developments can be made

Date of Writing: 10/5/2024 Contributors: ------- ------- Continued on:

Robot Take-Home #1 - Tweaks

During the robot take-home session, many developments have been made and will be made, and in the following pages what is done so far and what will be done until the next practice. To start, a lot of small tweaks have been made - note that the picture in this slide was taken at the same time as the ones that will appear in the following slides.

The following smaller tweaks were made to the robot, which did not need to be categorized into their own pages:

- Zip-Ties on top of lower intake

  A small change with multiple purposes. It means it can be used more to prove contact with things like the ladder for autonomous win points, can help prevent accidental double possession, and makes the robot look better.

- Intake mount re-gearing

  The intake is now mounted with sturdier metal gears.

- Tilted polycarbonate area

  Shifted slightly for contact

Date of Writing: 10/5/2024 Contributors: ------- -------

Continued on:

Robot Take-Home #1 - Lift

More of the same planned edits to the lift have happened, there were some more changes. As shown in the picture, you can first see that we replaced the regular chain with tank chain, because it is sturdier and after additional "fake" testing we realized that a regular chain is too fragile for what the intake might go through in rougher matches and such.

The hook was also very slightly changed - you may see that the polycarbonate has been cut to grab rings better, and a second and third hook have been added so as to be able to intake faster, more reliably, and with less risk of breaking.

All of them are made in the same way as the first: 2 standoffs with a pentagon shaped polycarbonate piece screwed on as a scoop.

Date of Writing: 10/6/2024

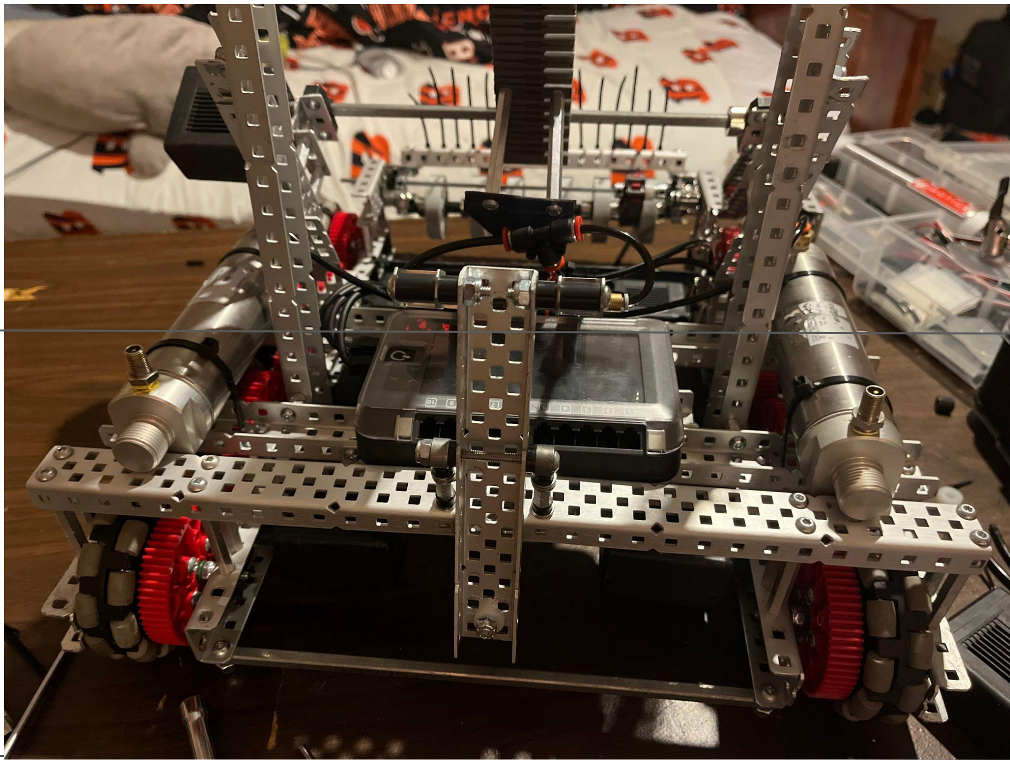
Contributors: ------- -------

Continued on:

Robot Take-Home #1 - Brain

Another very important (potentially the most) development made during the take-home session was the mounting of the brain, battery, 2 radios (a failsafe - for when one gets unplugged or loses connection during a match - this has saved us multiple times, and many other teams have used it, some getting the idea from us), and most of the necessary cords.

This is possibly the most important development so far because now the robot can be properly tested, and test pages can be published for all our previous design process sets. Additionally, this means that we can test autonomous programming and velocities, like autonomous PID and driver control settings (motor stopping modes, visual things on screen, gear correction, et cetera)



This also means we can do driving practice, so that we are more ready for our first game (s) of this season.

Date of Writing: 10/6/2024

Contributors: ------- -------

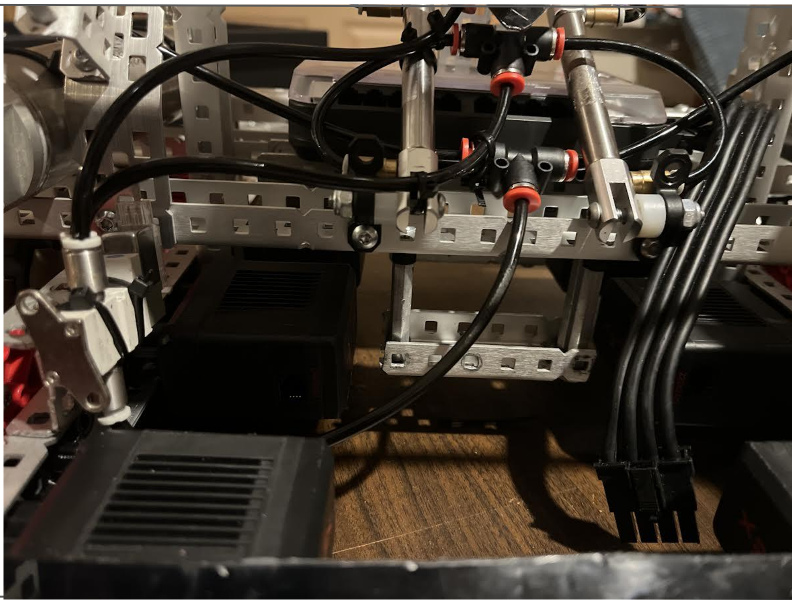
Continued on:

Robot Take-Home #1 - Pneum.

One more important thing that we have added, though only loosely planned before, were the pneumatics/tanks. We realized that the sides of the robot had perfect spots for the tanks, and that they would also be able to easily connect to the brain as well as the pistons that we planned to use for the clamp near the back. Those have all been placed on the robot.

The pneumatics and their system are important because we planned since the start to use them for the clamp, but slightly leaned ourselves more towards using motors - however after realizing that we would need to tilt the goal more towards the robot, even after shifting the lift as explained previously, we figured out that we could simply just use a single bar attached to the pneumatics to tilt back and forth to easily grab goals.

Additionally, having the pneumatics and their tanks on the robot means that we can, in the future, make more things with them if deemed necessary, like a hook for climbing the big ladder or something similar.

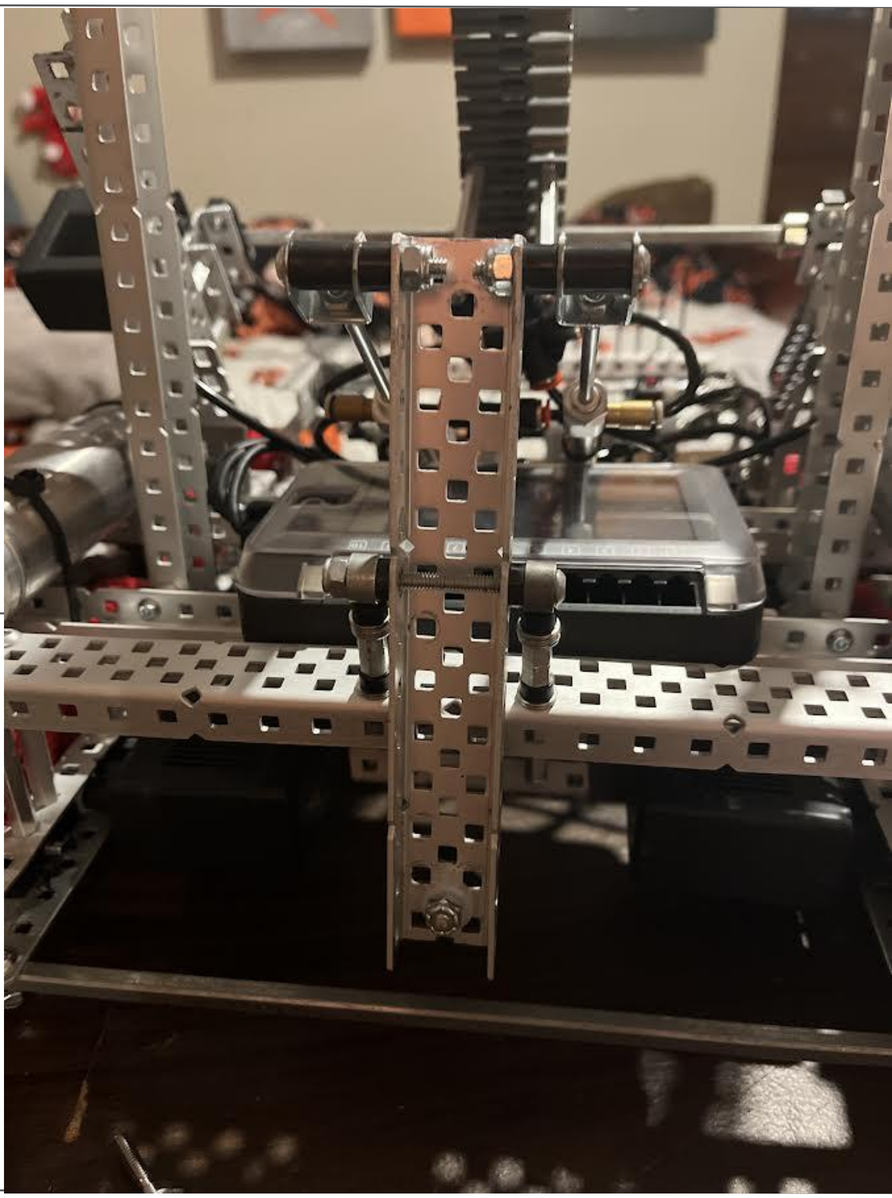


Robot Take-Home #1 - Clamp

As partially explained in the previous page, we have also finally added the clamp, though there were some changes since we remade it. Firstly, it's now just a simple bar - this works very well for how simple it is, and would be very easy to replace, tweak, or remove when needed. Since it is powered by pneumatics, we attached 2 parallel pistons to it for extra grab.

We will be testing it as soon as we're back to our school for practices, since we now have the 3D printed mobile goal, though it sort of seems to be a little bit inaccurate, it's all we have.

The clamp is tilted extra so that it could theoretically move the goal towards the robot more, so that the lift can slam rings directly onto it and score as efficiently as it possibly can.



Date of Writing: 10/6/2024

Contributors: ------- -------

Continued on:

Notebook Overhaul

After careful research, discussion with teammates and coaches, and consideration, I have decided to go with a modified version of Page 71's Idea 3. Essentially, almost every page will be sorted into being a step of the design process, and future pages will be made so that they fit specific parts of it especially, like a page where it's just going over autonomous testing we will ostensibly state that that is the purpose of the page, and then color code it blue, accordingly. This page will be a "select" page, as it selects an idea that was brainstormed in pages 70/71, and begins putting it into action. The table of contents, however, has been already changed accordingly and will continue to be in the future. Some pages that are uncategorizable (schedules, organizational stuff, etc.) will be colored in grey, with the design process pages being colored in red, orange, yellow, green, blue, and purple, as outlined in the "how to read the book" pages.

Regular design process specific pages will continue most likely, to show / summarize what happened in the core parts of each step in the process, as proof that we are working, designing, building, and documenting under the guidance of the Engineering Design Process.

Date of Writing: 10/8/2024

Contributors: ------- -------

Continued on:

Practice Goals/Plan 10/8/24

Once again, another regular 3:30-6:30 practice. ------- and I (-------) are the only ones present. ------- and ------- are on a field trip and will not arrive, and ------- is at football and will not arrive until later into the practice. Now that there is a brain mounted, we can finally do tests - and there will be tests today and probably pages about it. We will do some motor testing and setup, then my focus will be doing the notebook revamp and documentation while ------- works on the build.

Practice Plans:

- Do final intake tweaks
- Add motor cords and find ports and such
- Fix cords and ports in code
- Test motors
- Fix miscellaneous things found imperfect in testing
- Document everything that happens

Another normal practice, though only 2 of us will be present for the large bulk of it. A lot of the practice will be taken by testing and stuff like that, as we finally are able to. We have also received 25 blue rings from another group, so we can do more tests with that rather than us all sharing 1 red ring.

Date of Writing: 10/8/2024 Contributors: ------- ------- Continued on:

Code Readying + More Details

The code has been readied for the testing and such, as we have done tons of work on motor cords, ports, and coding them. Now that we have everything for that ready, and we previously had the drive code ready, we are about ready to test it. The drivetrain is now ports 10, 9, 8, 1, 2, and 3, our intake is port 7, our inertial sensor is port 18, and a clamp in pneumatic (digital-out, 3-wire) port B. It's ready for testing, though the cords are being set up and the robot is getting some other tweaks. The code for declarations and driving, as of now:

```
//declare electronics
brain Brain;
controller Controller = controller(primary); //primary - might add second ctrl later
//six motor drive, names are abbreviations. Port, internal ratio, reverse true/false
motor LF = motor(PORT10, ratio6_1, true);
motor LM = motor(PORT9, ratio6_1, true);
motor LB = motor(PORT8, ratio6_1, true);
motor RF = motor(PORT1, ratio6_1);
motor RM = motor(PORT2, ratio6_1);
motor RB = motor(PORT3, ratio6_1);
//intake motor
motor Intake = motor(PORT7, ratio18_1);
//inertial sensor
inertial Inertial = inertial(PORT18);
digital_out clamp = digital_out(Brain.ThreeWirePort.B); //clamp for mobile goals
motor_group LeftDrive = motor_group (LF, LM, LB); //left side motor group
motor_group RightDrive = motor_group (RF, RM, RB); //right side motor group
//drivetrain - numbers are wheel size x pi, track width, wheelbase, and gear ratio
smartdrive Drivetrain = smartdrive(LeftDrive, RightDrive, Inertial, 10.2102, 12.75, 12, inches, 0.6);
```

```
//motors - set axis - rpm scales with how far you push the joystick(s)
LeftDrive.setVelocity(Controller.Axis3.position() + Controller.Axis1.position(), percent);
RightDrive.setVelocity(Controller.Axis3.position() - Controller.Axis1.position(), percent);
Drivetrain.drive(forward);
```

Date of Writing: 10/8/2024 Contributors: ------- ------- Continued on:

Code Testing, Results, Changes

We have now done the first testing for our code, and we tried multiple different parts. Here are our results:

Drive Testing (Drivetrain, driving, turning, etc)

- Driving - “Perfect” from the start

Ran as intended, with correct scaling velocity, good torque, etc. and went quickly and smoothly. We are happy with it.

- Turning - Too fast, remedy unclear

Our turning is too fast, because due to how we have the joysticks set up the turning velocity is 100% (we are used to ~65%) by default and cannot be changed through the conventional method. I did some studying, but I have decided to make a VexForum post to figure this out, as we could not find a solution. Other than the speed, we are happy with it.

Intake Testing (Lower Intake & Higher Intake/Lift)

- Pickup - Subpar, though can be fixed

The intake did not pick up as well as expected in the lower part, though we have figured out that we could fix the velocity in the code and it would improve, and then lower it slightly (a very small fix) to make it work for us. The change was made, as it was simple, and did not require its own page.

Date of Writing: 10/8/2024 | Contributors: ------- ------- | Continued on: Page 84

Code Testing, Results, Changes

Intake Testing - Continued

- Speed - Subpar, though very easily remedied

  I didn't set the velocity high enough, and the sprockets are chained for too much torque. Changing both of these fixed it.
- Transition - Mostly working

  The transition area works fine, though every once in a while when the hooks coincide with where parts of the ring is it can slow down the process very slightly, but on the next hook's approach this is pretty much immediately fixed.
- Lift - Working, deposition unclear

  The lift works fine and as intended, though how well it deposits is unclear due to our 3D printed goal not fitting rings (the top is too big)

Clamp Testing (Angle, Pneumatic Speed)

- Speed - Pretty much immediate

  They're pneumatics, so there's very little delay. It works.
- Angle - Imperfect, easily remedied

  The angle isn't quite what we want, as it doesn't tilt the goal enough toward the back of the robot for ring deposition. This is easily fixed, and how we are doing it is by adding a bit on the end to catch the goal and tilt it a bit more.

Date of Writing: 10/8/2024 Contributors: ------- ------- Continued on:

Post-Test Changes

Intake and Upper Intake / Lift

- No major changes

Clamp Changes

- Slightly readjusted
  Tilted to the side a bit, more accurate
- Added buffer for correct angle
  Screwed a few spacers on the bottom part, it holds the goals at a better angle now.

Code Changes (Turning)

- Fixed turn velocity, now works
  Had to ask about this on VexForum after testing several things, but eventually decided I had to. @iseau395 gave me my answer, which was to simply multiply the axis 1 position by what percent turn velocity we would have wanted if the regular command worked for this situation. We decided on 0.75 (75%) as our reduction.

Other Building Changes

Prepared for re-sprocketing intake, as it isn't quite as fast as we would like.

Date of Writing: 10/10/2024 Contributors: ------- ------- Continued on:

Post-Practice Notes 10/8/24

Attendance:

- ------- and ------- present entire practice
- ------- not present (football)
- ------- and ------- not present (field trip)

Another regular 3:30 - 6:30 practice. This practice was different as only ------- and I (-------) were present, and so most of the practice was taken up by testing and tweaking based on those tests, as per the Engineering Design Process. Otherwise, I did some more code research, and looked up some concepts we might use on VexForum, and then I documented our tests as best I could to prove our process. Meanwhile, ------- did the tweaks we found necessary via our tests, and helped move the robot closer to being ready for a tournament.

On Thursday (next practice day) morning, we will also have a split (by our school lunch break) 1-hour build/development period where we will be making some small changes and I will finish documenting what happens. Everyone will be present for this, and everyone will be at the later practice for the entire time except for ------- who says he will be there for a majority of the time.

Date of Writing: 10/10/2024 | Contributors: ------- ------- | Continued on:

1-Hour Build Day 10/10/24

Today, in our morning Engineering class, we have 1-hour build day. It comes in 2 30 minute periods as we have lunch in the middle. Our whole team is here for this entire thing, and we plan to just do small tweaks and tests, and observe the idea of using 2 5.5 watt motors on our intake rather than 1 11 watt.

During the first 30 minutes we discussed the 2 5.5W motor idea, and eventually agreed on doing so. We removed the chain and started putting them on. We also reinforced part of the intake connector bar with more screws to make it extra durable and stable. Additionally, we removed the 11 watt motor which the two parts of the intake were sprocketed to, so that we could put the 5.5 watt motors on each part individually. I made the necessary code (new motors + motor group) for this.

During the second 30 minutes we actually put on the 5.5 watt motors, and tested them. We initially found them to have too little torque, but we realized that they weren't fully connected. Now that is fixed, and we are doing very basic code tests on them, though they seem to work quite well. The pneumatics (clamp) were tested a little more and are still up to standard - we were seeing how the strength scaled with air.

Date of Writing: 10/10/2024

Contributors: ------- -------

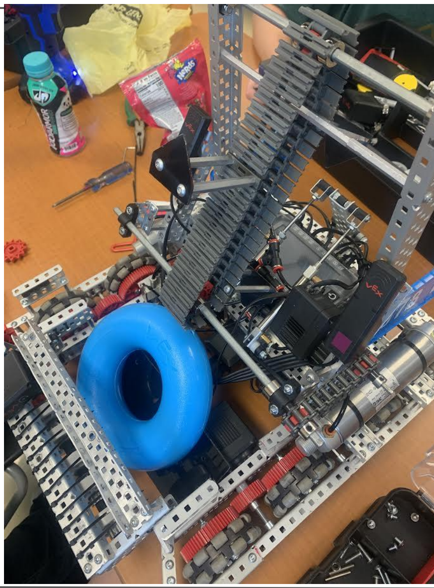
Continued on:

Pre-Practice Notes - 10/10/24

This practice, all of us are present except for -------, who will arrive at about 4:30. A normal practice, we will be focusing on finishing up the intake so that we can do a bunch of tests and code and such. We finally got a 3D printed mobile goal with a correct-size top for us to deposit rings on that we can finally test with.

Practice Plans:
- Add 5.5 watt motors completely to intake
- Test the 5.5 watt motors in code
- Finish re-chaining intake
- Run drive / turn velocity tests
- Test with mobile goal
- Document it all

Pictured here is our robot as of the start of today's practice, with a ring in it for scale and showing of storage. Today we will be using these rings and our new goal to find out if we deposit rings correctly, and maybe have a sort of ramshackle scrimmage with our limited amount of field parts (only rings)



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The Intake Jam Issue - Part 1

Our first thing we did this practice was to re-test the intake after we edited it during this morning's 1-hour build time. We realized that it still has the jam issue, where the ring gets stuck in the spot shown in the picture below. We have had this issue for a little while, and it is part of the reason why we "tweak the intake" in almost every build / post-build page. Now, we think we have the answer for this, which is adding polycarbonate.

We already have a sheet of it on the lower part of the intake, but there is an open space that the ring falls into, which we will also be covering with polycarbonate so it does not fall in that area.

We have found newer sheets of the material, so it will be less beaten up than the pieces we have used before, which also means that this time it will move smoother.

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Polycarbonate Siding Idea

Recently we were thinking about the issue that many robots, including possibly ours have, which is that rings, other field elements, or other robots can get stuck under ours which can lead to a disqualification on either side or our robot breaking possession rules, or in the most likely case, it simply not being able to move anymore due to being caught.

What we have done in the past years, which has worked very well, is placed polycarbonate sheets on each side of the robot as to prevent this, and also to serve as a shield to prevent other stuff from hitting the robot or items getting stuck in the motors or gears. We will likely cut from the piece below.

However, the rule <R19> says that there can only be a limited amount of polycarbonate, being an amount that would be able to be cut from a 12” x 24” sheet of it. We already use a good amount in the intake, so these siding parts would probably be much smaller than usual, however they are usable.

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The Intake Jam Issue - Part 2

After testing, adding the polycarbonate solved one problem, but brought to light another. The current issue is that the rings kept getting jammed in the intake. The exact reason isn't clear, but after analyzing more, we have a set of ideas:

- Shorten standoffs on underside of intake
  If they are gone, the ring cannot get stuck on them.

- Add new standoffs on top
  If we add new smaller standoffs to the topside of the lower intake, the ring can not flip over the top and get stuck above the intake.

- Add blocking layer on top
  We could add a small layer of metal or other material to prevent the ring from exiting the intake from any other way than via the upper part, so that it does not escape.

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Ring Deposition Problem + Fix

Our lower intake is fixed for now, however now that we have had the ability to test with a working goal, the clamp angle is apparently off, which we did not know as no rings were able to fully go on the older 3D printed goal. They would bounce off.

The rings land on the goal either barely and like in the picture, or bounce off the front, so we need to fix the clamp.

From our tests, we found that when we move the clamp and adjust the goal a certain way, rings will deposit in a perfect way. The goal is to set the clamp to hit that angle.

We decided to do this by supporting the bottom of the clamp with standoffs (so as to limit how far down it will go when it grabs the goal) and this appears to work fine. We have tested it a little more.

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